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AVIATION

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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

Louis F. Stoll, Vice-President
S. Paul Johnston, Editor

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The case for lighter-than-air in intercontinental commerce

Transoceanic Airships

By Dr. Karl Arnstein

Vice-President and Chief Engineer, The Goodyear Zeppelin Corporation

THE advancement of civilization is closely connected with improvement in the art of crossing the seas. Communication by air seems to be destined to help break down the barriers between nations now physically separated by the great oceans. In order to properly appraise transoceanic air transport, however, it is first necessary to analyze the nature of the social, business, and cultural contacts among the peoples of the world. On the basis of such an analysis a specification may be drawn for a vehicle best suited to furnish the required services.

We in the United States are vitally interested in frequent and fast crossings of the Atlantic and the Pacific in order to reach the markets of Europe and the Far East. European nations also need means of fast communication with America and with outlying colonies.

Although aircraft will naturally be inferior to seagoing vessels with respect to bulk of payload carried, they possess a considerable advantage in speed. The top limit of sustained speed for ocean-going ships has practically been attained and it is only natural that people and cargoes requiring faster transportation will turn to the air.

Every week some 700 000 lb. of mail crosses the Atlantic in both directions. About 10 per cent or 70 000 lb. is first class mail. Eastbound, about 30 per cent of it is to be delivered in England, 15 per

cent in Germany, 10 per cent in France and 10 per cent in Italy. About one-third of this total first-class mail is specifically designated by the sender for sailing on the next fast ship. This amount of mail, therefore, could be expected to be diverted to air transportation, particularly if the premium to be paid would be small.

Since no international express business exists today, a statistical forecast of the amount of express traffic which might be developed for transatlantic aircraft lines may not be made. An investigation of the possibilities, however, has shown that considerable potential traffic exists. The same need that has created railway and air express systems overland is urging speedier transportation for premium merchandise across the high seas.

As to passengers, it is safe to assume that a large percentage of those now paying substantial premiums above minimum first-class rates to travel on fast super-liners will be prospective air travelers. More than 20,000 passengers in this category cross the Atlantic in both directions each year and pay for superior accommodations on these super liners.

Many persons not now traveling across the ocean may be considered prospects for air services. Some do not travel because of lack of time, others refrain from crossing the ocean because they are subject to sea-sickness.

Making due allowances for present and potential future traffic, a transatlantic air service could count on a potential market of about 30 000 persons per year. One airship of a type now being studied with accommodations for some 80 passengers could take care of only about 4 per cent of this potential passenger market over the Atlantic. Over the Pacific, one airship of this size could handle only about 8 per cent of the present tourist traffic to Hawaii. In service between Europe and the Far East, about 16 per cent of the potential air travelers would be required to fill it.

Requirements for ocean service

The four primary requisites for any commercial transportation vehicle are (1) safety, (2) performance, which embraces adaptability and economic merit, (3) speed, (4) passenger comfort. These four attributes will be found to exist in a greater or lesser degree in all forms of transportation. The differences between various means are due to accentuation of certain of these features. The traveling public makes a choice according to the particular attribute which seems of the greatest importance at the moment.

In air transportation the number of alternate vehicles is somewhat limited but the measuring stick may be applied to various types of aircraft such as airplanes, flying boats, and the airship.

A glimpse into the future. These sketches are taken from a study made by the Goodyear Zeppelin Corporation of an 80 passenger lighter-than-air ship with accommodations which compare favorably with those found on 'luxury' steamships today.

None of these alternate forms are competitive in nature unless they are able to supply the four attributes of transportation in exactly the same distribution and quantity. Each of the four must be considered as a factor in a vast system of transportation embracing all fields and including all variations of combinations which may be dictated by the requirements of all comers. They must be considered as interrelated rather than strictly competitive. There may be tendencies for the fields of utility to overlap, but critical analysis will generally show that one of the apparently competing vehicles is supplying a slightly different type or quality of service than the other.

The fundamental requirement for safety in any engineering project is the proper visualization of the potential risks. The engineer must realize and appreciate all conceivable risks which may arise and he must then shape his designs so that they are accepted and provided for in the proper order of their relative importance. For transoceanic service the public has a right to expect that the means of transportation suited for this particular type of service will have a mechanically strong structure. It is to be accepted, however, that no structure can be designed for mechanical safety alone, disregarding performance. The structure must involve the minimum of risk without neglecting performance and economy. Any craft must be expected to be inherently sound and to permit safe operation, although as a practical matter it is impossible to evolve a design completely foolproof against any possible combination of unfortunate operational occurrences.

The public is justified in demanding that the operating personnel be well trained and experienced in the proper handling of aircraft. The best protection for the traveler is a well designed craft operated by a competent crew.

Any successful commercial aircraft must be able to perform regularly in a reliable way, adhering to a schedule set well in advance. It is obvious that it must be sufficiently economical that the operator may offer attractive rates and so draw the patronage which he needs to make the venture profitable.

The public wants as much speed as it can get without sacrifice of comfort and safety. The operator will offer as much speed as will be tolerable financially and therefore will not fly faster than is required to meet an acceptable schedule. Success or failure for any craft will depend on the proper compromise between these two ideas.

It must be understood, however, that the traveler or the shipper is interested only in total elapsed time for the whole journey and therefore the time lost by intermediate stops and cargo transfer must be taken into consideration. In order to appear attractive, elapsed crossing time for any proposed new service must compare favorably with that of the existing modes of transportation.

Travelers on transoceanic routes will rightly expect comfort comparable to that to which they have been accustomed on seagoing vessels. The traveling public never hesitates to pay a premium for better accommodations. The operator, however, must examine every addition to the convenience of the passenger in the light of the penalty which it imposes on payload so that he will not unnecessarily penalize his prospective revenues.

The transatlantic airship

Consider now the airship as a transatlantic vehicle.

When I say that the true field for the airship lies in transoceanic air transport I would like to have it clear that this is considered as one type of service into which the airship fits very well. The airship, however, is not the only vehicle in this field. Surface vessels have been, and for many years to come will be the most important factor in transoceanic commerce. Speedier traffic, to be sure, must take to the air, but even the most enthusiastic proponent of the airship realizes that only a portion of the traffic can be economically carried in this modern manner. Just as there will be differences which prevent aircraft from completely supplanting surface craft, there will be factors which will prevent any one type of aircraft from completely dominating the air-borne portion of transoceanic traffic.

I believe, however, that the airship is destined to be successful in the transoceanic field because its inherent qualifications permit it to carry large paylonds economically over long distances.

And the commercial airship will be acceptable as a safe means of transportation. To those who are inclined to remember airship disasters rather than airship performances, the subject may seem somewhat controversial. The true facts as to airship casualties are available but unfortunately have never received proper distribution. The development of the airship has extracted a far smaller toll of human life than has attended the development of many other commercial and military vehicles.

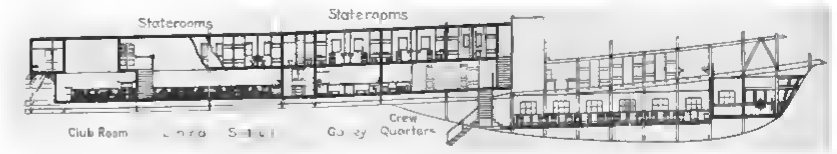
Regarding safety, the Durand Committee, recognizing the impossibility of writing an absolute specification for safety for any vehicle stressed the idea of a *reasonable* degree of safety. We all know that it is possible to build structures which will closely approach the ultimate in actual safety. Those of us who work in aeronautics where weight restrictions are ever present realize that we must content ourselves with a reasonable safety if our aircraft are to fly at all successfully. Assuming that the loads are known and the properties of the structural materials are also known, it is possible to fabricate aircraft structures which certainly are safe enough, and it is the natural assumption that these things will be done. For every type of structure, however, there are certain inherent safeguards resulting from overlapping of functions which give greater safety than could be obtained from the consideration of individual factors.

The rigid airship is particularly gifted with a number of these inherent safety factors. Of primary importance is the independence of buoyancy and propulsion. It is not necessary for the airship to retain forward speed to stay aloft, and its safety is relatively little dependent upon its power plant. A striking example of this feature is one voyage of the Graf Zeppelin which was interrupted by failure of four out of five of its power plants. The cause of these failures is now definitely known and repetitions are highly improbable, but the fact remains that the airship was safely returned from mid-Atlantic with only 20 per cent of her total power operating. On the first voyage of the LZ-129 to South America she experienced failures on two of her four engines. Repairs were effected in flight so that there was no danger to the ship at any time. It actually arrived at its home port somewhat ahead of schedule because it took a shorter route.

Another safety factor is the redundant character of airship structures whereby local failures of structural elements do not of necessity cause total failures of the structure, nor do they always necessitate forced landings. Skillful crews brought back several of the wartime Zeppelins after they had been badly crippled by enemy action. The Shenandoah and the British R-33 were brought safely home under their own power after the nose sections had been torn out at mooring masts.

The buoyancy of the airship is safeguarded since there are a number of gas cells involved, corresponding to watertight compartments of surface vessels. The degree of such compartmentation depends upon the probability of gas loss and on the means provided for correction of the deflation moments and the loss of equilibrium which would result.

But all inherent safety advantages and all painstaking engineering research and design are of little avail if the aircraft is not operated properly. In the future more thought must be given to the folly of utilizing aircraft of all types on occasions or on missions for which they are not suited. Operational safety can never be secured until aircraft operators are freed from pressure to operate under conditions which for aerological, technical, or engineering reasons are not as safe as could be desired.



Speed of airships

Heretofore, over the Atlantic, seagoing vessels have been the only existing carriers. The fastest steamers now make the crossing in 4½ to 5 days, requiring 5 to 5½ days for delivery of mail between New York and Paris. A two- or three-day airship service between the same two points would deliver passengers and mail at the same time as a ship which sailed three days earlier. To arrive earlier by air than by any steamer, airships must therefore sail twice a week. More commonly, mail is delivered in western Europe by slower ships on the sixth or seventh day after sailing from New York. Over these longer routes, in order to obtain a worth-while saving, the airship should be a two- to three-day ship which would leave the United States say on a Friday morning, arriving in Europe Sunday before midnight, leaving half a day for delivery of mail Monday morning.

The airship has demonstrated and claimed only a useful degree of high speed and not the superspeed attained by airplanes over shorter distances. The opinion has been advanced that airships are obsolete because they are not as fast as airplanes. This does not mean, however, that the elapsed time for ocean crossing need necessarily be higher, as a comparison of airplane schedules over long distances with actual time

consumed by airships will prove For example, the Graf Zeppelin, in over 100 ocean crossings, established an average ground speed of 62 miles per hour The speed of airplane schedules to South America computed on an elapsed time basis shows figures between 55 and 61 miles per hour This is explained by the fact that airships may be operated through fog and under such visibility conditions which are not commercially tolerable with heavier-than-air craft. Airships regularly fly day and night over uncharted and unlighted airways The long-range performance permits flying on great circle routes and permits "weather map flying" where advantageous or desirable conditions for comfort and safety are to be found Experienced operators often take advantage of strong winds in the vicinity of storm areas to increase their ground speed. Most important of all is the possibility of avoiding intermediate stops for refueling, servicing or inspection, with attendant losses of time The airship flies non-stop until it reaches its destination

Economic performance

In order to appraise the economic possibilities of the airship, compare its services with that rendered by heavier-than-air craft The airship cannot compete with modern high speed airplanes over short overland routes Over the ocean, however, it has many advantages An airplane cannot reduce its speed under a certain minimum and it must land after its fuel supply has been exhausted or its propulsive power crippled An airship, on the other hand, can reduce its speed and can hover for almost unlimited time until the condition can be corrected or until help can be summoned

One of these days airplanes will seriously attempt the route to Europe by way of Bermuda and the Azorrs or the longer route by way of Greenland and Iceland The length of these two routes is appreciably greater than the Great Circle course, and the added delays at intermediate refueling points will tend to offset the advantage from the airplane's greater air speed If the two kinds of services are offered and if the elapsed times are not widely different, then it becomes a question of sailing frequencies, payload capacity, comparative safety, comfort and cost I believe that the airship will be more attractive to passengers and will carry large loads much more economically.

The contemporary airplane seems to return the greatest revenue on non-stop flights of less than 1,200 miles. The payload of an aircraft vanishes when the distance is so great that all its useful load is taken up by fuel It has been frequently stated that the most economical flight distance is that where the fuel load is equal to the payload For a contemporary airship, the economic distance would be more than 3,500 miles and the cost between 25 to 50 cents per ton-mile (depending on the type and number of ships in service, etc) This cost would cover all expenses, including terminal charges, amortization, etc , and yield a fair profit. Dr Eckener figures that a charge of 10 cents per passenger-mile (which would mean a revenue of $5 per mile for 50 passengers) on the Hindenburg would pay for the total operating cost Besides the passengers the Hindenburg has a payload capacity of more than 40,000 lb for mail, freight and express Furthermore, if it would seem desirable, there is no reason why on heavily traveled routes, accommodations for additional passengers could not be provided to increase the revenue. With present arrangements, Dr Eckener would also be able to offer his 20 to 30 tons of payload from 16 to 25 cents per ton-mile if he wanted to cover the revenue from this source alone. If Dr Eckener would transport 20 000 lb of mail on each weekly trip (about 30 per cent of the weekly mail) and if he would have no revenue from either passengers or freight, a charge of only 2½ cents per letter would cover his whole operating expense It is quite conceivable that this price could be included in the present European rate

Compare the performance with a modern flying boat such as is now being used in the Pacific. The boat takes off for a 2 400-mile trip loaded to more than 25 tons and arrives at destination with less than 1 ton of payload It is understood that the government's payment of $2 a mile for this service does not cover operating expense This would mean that a rate of over $2 per ton mile would have to be charged, and on this basis the charge per letter across the Atlantic would have to be about 10 cents The $2 per mile figure for the flying boat should be compared with about 15 cents per ton mile for the airship operating on a similar basis Even if credit is given to future developments which would make possible the flying of airplanes on transoceanic service carrying small payloads with similar efficiency as is now possible on overland routes and with reasonable safety, the total cost per ton-mile will still be very high in comparison with airship rates What is more, improvement in future airships will tend to keep the relative costs the same If we grant that people will pay the high airplane rates, then there should be many more who will find the airship rates more attractive

Again, it should be borne in mind that the airship is not the only means of ocean air transportation However, I do not feel that airship and airplane services should be considered as competitive, but rather that they should be coordinated Passengers going across the ocean will most likely use an airplane to reach the point of departure, then board an airship, and after the ocean crossing, go to the final destination by airplane It is possible, however that under certain conditions and with highly developed equipment, the airplane may be given preference over the airship on those occasions where urgent individual transportation appears necessary regardless of cost, safety and comfort As a step in this direction we now have designs in the project stage which consider the carrying of airplanes on commercial airships as feeders and distributors to enable further saving in time to those who can pay the price.

Passenger comfort

In the matter of comfort, the airship may be compared with any mode of transportation and will be found to be superior in many respects. It is not only possible to supply many of the luxuries available on steamships but each passenger will have plenty of spare allotted to his own use and will be able to enjoy the sociability of numerous public rooms. Smoking rooms and shower baths are incorporated in present designs and observation rooms and long promenade decks will also be provided. Those who have yet to take their first rigid airship ride will find it a pleasant experience Due to the large size of the ships they are steady and passengers experience little or no sense of motion For this reason, sea-sickness or air-sickness is unknown There is no noise or vibration from the engines and ventilation is easy to obtain The ship may be kept free from the odors of food and fuel.

It is very gratifying that a committee of leading American scientists of international reputation have arrived recently at the conclusion that safe and useful airships can be built and operated for both commercial and military use Dr Eckener and his associates have also continued to give proof of the justification of these findings.

Dr Eckener said recently "The extended voyages of the Graf Zeppelin prove, in my opinion without a shadow of doubt the practicability of airships for commercial use. It is for this reason that an airship service between the United States and Europe should be inaugurated with a minimum of delay, particularly in consideration of the immense significance and importance of this busy traffic line across the Atlantic"

Dr Eckener has done much to approach his goal His recent voyage of the Hindenburg on the first of its ten experimental flights is only the beginning The great awakening of American interest in these flights indicates that the day is not far distant when American airships will be built to participate in this service and to play the part to which America is entitled in the development of overseas commerce in the air

Acknowledgment is due to Mr. Lester D Gardner for his assistance in obtaining this paper.—Ed

Broadcast Beacons

By John P. Gaty
Fairchild Aerial Camera Corporation

Last month the author discussed the radio compass, its installation and general usage. In his second and final article he deals with some of the faults to which the device is heir, and also sets up and solves eight typical navigational problems involving its use. Appended is a table showing the location of 54 of the major broadcasting stations with respect to the nearest airport.

THE PILOT who adopts a radio compass for navigational use should always keep in mind the important fact that the radio waves are part of an uncharted sea Just as ocean rollers recoil from the shore, radio waves are reflected and distorted by mountains and other terrestrial objects There are also other influencing factors which have not been explored and evaluated.

Certain spots have been located where false indications occur In a few extreme cases the radio compass may indicate the position of the homing station within a circle which is actually miles away from the station itself. These locations seem to be fixed, however, like a false cone of silence on an airways beacon, and the same false indication will be found each time the area is entered The size of these peculiar areas of distortion is ordinarily quite small and the pilot can readily check them by flying for a few minutes on a fixed heading in any direction which approximates his original course The radio compass indicator will then show the true direction to the desired station If the station actually were within the false circle, the radio compass indicator would show a fairly constant stern bearing influenced only by what ever drift there happened to be present.

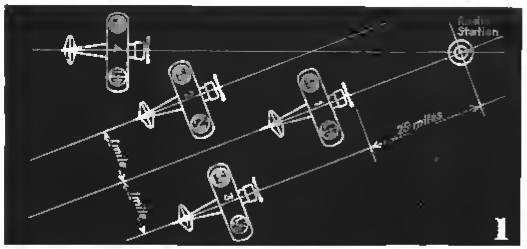
When a new airways beacon is put into service it is carefully flight-checked for course alignment, multiple courses, false cones of silence, and other aberrations No one would intentionally use it for bad weather flight until these measurements were completed, except in an emergency that justified taking a chance The same care should be observed in the use of the radio compass for blind approaches If the district is strange to the pilot, extreme caution should be combined with intelligent analysis of the indications of the radio compass At regular airports-of-call the pilot should survey the 'radio sea" which surrounds the airport, during clear weather, and definitely locate any local areas of radio distortion If none are found he may use the radio compass with confidence during bad weather approaches.

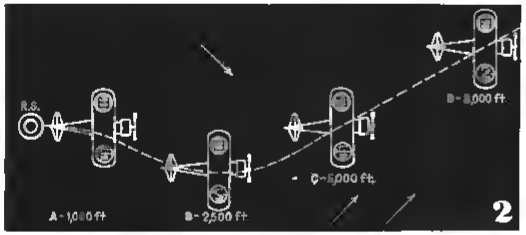
Night effects

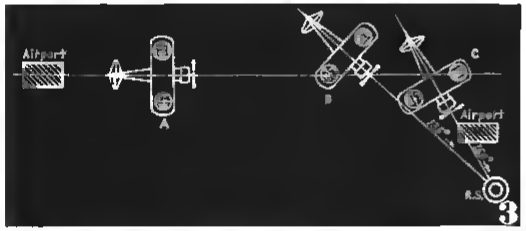
The radio compass gives an accurate indication of the direction from which the radio signal comes If it is tuned in to one station (without interference) it ordinarily gives very accurate bearings within one degree, but under certain special conditions of the atmosphere the radio wave front itself is distorted. These errors are found most frequently at sunset and sunrise and sometimes occur at night They also are responsible for the well-known variation of certain beacon courses, and swing the on-course zone from side to side

The presence of "night effects" is usually indicated at the radio compass indicator by a waving or slow oscillation of the indicator needle back and forth across the zero reading A mean heading can be taken and maintained by directional gyro, and the oscillations averaged out Any constant error might deviate the course temporarily but if the radio compass were used all the way to the station it would mean only that the course flown would be curved or waved slightly instead of straight

If two stations are transmitting simultaneously on the same frequency there is a possibility that an erroneous indication may be produced by the radio compass The radio compass will perhaps indicate a direction toward neither station but will indicate a direction controlled by the summation effect of the relative positions and received signal strengths of the two stations Such errors decrease as the selected station is approached because the ratio of strength of the desired signal to that of the undesired signal becomes





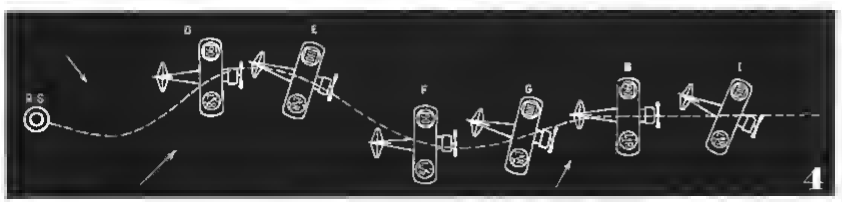


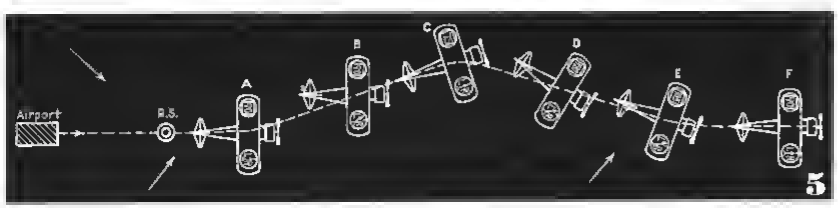
so large that the undesired signal has a negligible effect

The use of 'clear channel" stations therefore is of primary importance for long distance radio navigation There has been some research expended on this problem and the first conclusions, for broadcasting stations only, are contained in the February issue of *Electronics* (McGraw-Hill Publishing Company) and tabulated on page 18 herein A further study of this problem is necessary in order to combine both broadcasting and beacon stations into one table which can be used by pilots

Beacon stations cannot be considered as "clear stations" in all cases As an example, the airways beacons at Buffalo, Boston, Camden, Indianapolis and Atlanta all operate on the same frequency of 266 K C It would be unwise to attempt to obtain long distance bearings on these stations, especially from the neighborhood of Charleston W Va., or Pittsburgh When within 100 miles of any of these stations, except the low powered Camden beacon, satisfactory results could be obtained For long distance bearings an analysis should be made of the interference situation, keeping in mind the location of the various interfering stations with regard to the positions of the station and the aircraft

Diagram 1 Determination of Track by Radio Compass and Gyro. The three airplanes numbered 1, 2 and 3 are all on the same heading of 90 deg true as shown by the directional gyros drawn on their left wings Only No 1 is on the 90 deg track which passes over the radio station The pilot of this airplane knows that he is on this track because the radio compass indicator is centered at the same time that the gyro indicates a 90 deg true heading If he were off the track to the left the radio compass indicator would indicate LEFT as shown on airplane No 2 If he were on the track to the right the radio compass indicator would indicate RIGHT as shown on No 3 If he were off the track to the left and he





centered his radio compass indicator his gyro heading would change, as shown on No 4 For this reason a definite and predetermined track can be maintained by the use of the radio compass and gyro in combination The limit of accuracy to be expected under average conditions is shown in the diagram The ratio of 20 to 1 expresses the relation between the distance to the radio station and the distance of maximum error from the selected track This would mean that at 150 miles from the station a maximum track error of 8 miles could be expected This error keeps diminishing as the station is approached because it is a function of the reliable scale of instrument indication The figure of accuracy used here is based upon experience and allows for the summation of several possible errors Theoretically the radio compass is capable of twice this accuracy

From the above explanation it is obvious that there are an infinite number of different tracks passing over the radio station Any of them can be flown in the same manner with out regard to whether the aircraft is approaching the station or leaving it

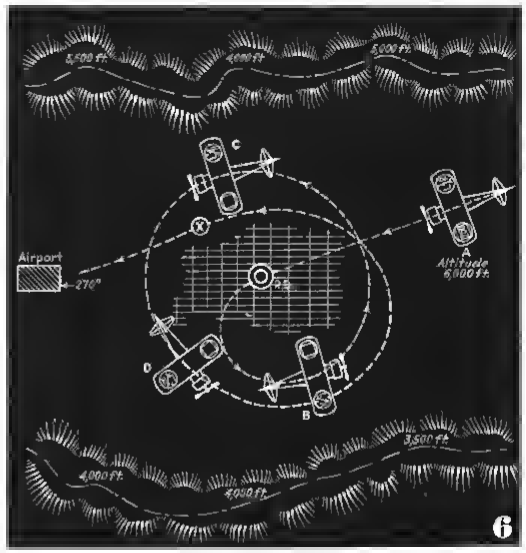
Diagram 2 Determination of Drift by Radio Compass and Gyro. Assume that the airplane leaves the radio station on a point of departure with a heading of 90 deg true As it passes through the lower levels it encounters a NW wind of low velocity and drifts slightly south of the desired 90 deg track The radio compass indicator immediately notifies the pilot of the direction of drift by swinging towards the RIGHT as shown at position B As the aircraft continues to climb however it encounters the upper winds blowing from the SW with considerable velocity If the original heading is maintained the airplane will drift back across the desired track (at position C) and the radio compass indicator will be temporarily centered. As the flight continues on the original heading the aircraft will drift to the North of the desired track and the radio compass indicator will swing LEFT as shown at D

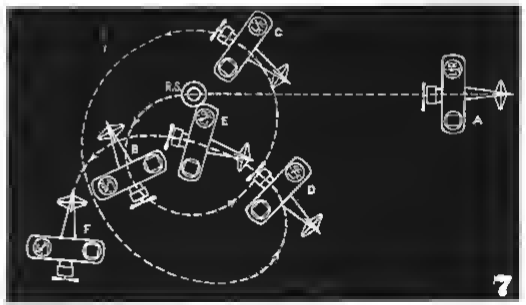
Diagram 3 Locating an airport by means of one off-course radio station under conditions of bad visibility In this case the pilot wishes to fly from one airport to another but the only radio station in the vicinity is 15 or 20 miles from his destination and also is off-course The main consideration is to intersect the *radio track*, which passes over the destination airport to the radio station, at a point beyond the airport and then fly down this track until the airport is visible

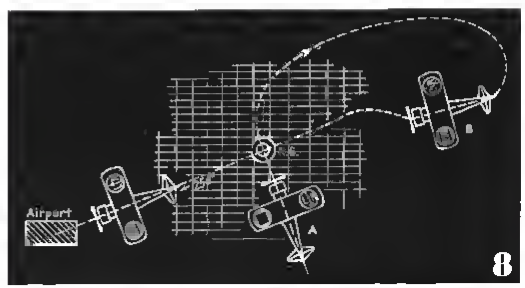
The pilot establishes a dead reckoning course as well as possible and flies with the radio compass turned off as at A The dead reckoning course is laid out to intersect the *radio track* beyond the airport and when the pilot believes that he is approaching the intersection he turns on the radio compass and swings the aircraft towards the station to take a bearing as at B In this manner he estimates his arrival at the intersection point When this is reached he flies down the radio track until the airport is visible If he misses the airport he continues to home on the radio station until it is reached then turns around and flies a reverse course along the same *radio track*. The location of the airport can accurately be determined the second time on its location along the track can be established fairly well from the airspeed and elapsed time from the radio station

Diagram 4 Maintaining Track With Radio Compass and Gyro. From position D which was reached by the airplane in diagram 2 the pilot wishes to resume the selected 90 deg track in order to pass over favorable flying country His radio compass indicator shows a LEFT indication when the gyro reads 90 deg and therefore he knows that he has drifted to the left of the course He turns right to a 110 deg heading to E1 and flies to position F where he temporarily swings to a 90 deg heading and observes the radio compass indicator. It indicates to the *RIGHT* and he therefore knows that he has overcorrected for drift and is now to the right of his selected track He decreases his heading to 100 deg (as at G) and flies to position H where he again takes a temporary 90 deg heading The radio compass indicator is centralized and he then knows that he is on the selected track but had a 100 deg heading will allow him to drift left He changes the heading to 100 deg and flies the track to the destination subject to further checks

Diagram 5 Direct Determination of Drift by Radio Compass and Gyro. The pilot leaves the field and executes a homing course on a radio station enroute, in the meantime climbing to selected altitude He desires to fly a 90 deg true course from the radio station to his destination As he passes over the radio station he assumes a 90 deg heading and turns off the radio compass (position A) After flying for a predetermined time (say five or ten minutes) he reaches position B and turns







on the radio compass. The needle will indicate left due to drift caused by the SW wind shown blowing at the selected altitude. The pilot then should give *left* rudder until the compass needle is centered (position C). The gyro now will indicate the actual heading of the course made *good*. In this case this heading is 75 deg true. The difference between 75 deg and 90 deg is 15 deg which is the actual drift angle. By adding *twice* this angle, or 30 deg, to the selected track heading of 90 deg, the pilot will take a 120 deg true heading (position D) and fly for a *slightly greater* period than was allowed for drift determination. He will then arrive back approximately on the selected track (position E) and can take a 105 deg heading and fly the track to destination subject to further check as at F.

Diagram 6: Descending through total overcast in a spiral around a radio station. Assume that at the desired destination there is a 1,000 ft ceiling and that the town and airport are surrounded by high mountains entering the overcast. The pilot can descend safely through it by using any *radio* station located more than 2 or 3 miles from all mountains. A homing course is flown at sufficient altitude to clear all obstructions (as at position A). Drift can be determined for direction but not magnitude during the approach. When the station is passed the aircraft is turned to one side or the other and a descending spiral is started around the radio station as a center. The *turn-and-bank* indicator is carefully watched to maintain the maximum safe rate of turn and keep the radius of turn *less than half the shortest distance to any obstruction*. The radio compass needle will remain pointing to the outside of the turn as long as the spiral surrounds the radio station. The maximum distance that the aircraft can reach from the radio station is twice *the radius of turn* as long as the radio compass indicator points away from the center of the turn. If wind causes the spiral to drift away from the station the radio compass needle will slowly approach the centre position and then reverse to a reading towards the center of the turn. As the turn is continued it will pass from side to side. This condition should be prevented by the use of the rudder when the needle first approaches centre. (Diagram 7 indicates how this condition occurs.) As the aircraft descends it will eventually break through the overcast as at X and the airport can be reached by any desired method.

The identical method can be used in an ascending *spiral* for departing from this type of airport location.

Diagram 7: Explanation of radio compass action in a spiral around a radio station. Commercial *radio compass* indicators are made to indicate departures from course in the same sense as a bank-and-turn indicator. They therefore point *away* from the radio station. In the diagram A represents the homing approach, B represents the beginning of the descending spiral, C represents the first half turn, D represents the point where the radio compass indicator becomes centered due to drift, E represents reversal of the indicator needle due to passing the station on the *wrong side* and F represents the second reversal of the indicator needle as the turn continues. Prevention of this type of spiral depends on taking action at position D. If the pilot rudders right and passes the station well *to his left* the aircraft cannot drift away from the station for a greater distance than twice the radius of the spiral. It is for this reason that the radius of the spiral must be substantially less than one-half the distance to the nearest obstruction. The approximate direction of drift can be estimated by observation of the gyro heading at the time that the indicator needle centralizes the first time. The subsequent corrected course will be into the wind, unless the spiral has been irregular.

Diagram 8: Blind approach to airport with low ceiling and visibility (not zero). To solve this problem the true bearing from the radio station to the airport and the distance *must be known accurately*. Any homing approach can be made to the radio station (as at A). As the station is passed the pilot turns away from the airport and flies approximately 10 miles back of the station away from the side on which the airport lies.

He then turns toward the station and attempts to pick up the radio *track* passing over the station to the airport. (See diagrams 2 and 3.) At position B the aircraft is off the track to the left as indicated by the radio compass indicator. If the track is located and no drift is indicated on the approach (by the action of gyro and radio compass) the track can be held to the airport and altitude can be lost between the station and the airport so that the ceiling will be pierced at a safe point. If drift is indicated on the approach the system of Diagram 5 can be used to definitely establish the drift angle and another approach made. The established drift angle can be used for course compensation on the second attempt.

BROADCAST STATIONS SUITABLE FOR AERONAUTICAL DIRECTION FINDING

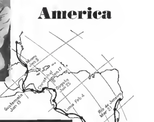
Location by States	Call	Freq in Kc	Power in Kw	Interferences	Antenna Location: Longitude ° ′ ″	Antenna Location: Latitude ° ′ ″	Approximate Locality of Antenna
ARK., Hot Springs	KTHS	1090	10	42*	93 02 06	34 28 45	3 mi. e. Hot Springs. 2 mi. e. Airport.
CAL., Belmont (San Francisco)	KPO	680	50	15*	122 14 00	37 32 30	
CAL., Buena Park (Los Angeles)	KFI	640	50	30*	118 00 50	33 52 47	20 mi. s.e. Los Angeles
CAL., Los Angeles	KNX	1050	50	27	118 28 16	34 07 25	5 mi. s.w. of Van Nuys, California
CAL., Oakland (San Francisco)	KGO	790	7.5	32	122 12 20	37 45 54	
COL., Denver	KOA	830	50	25	104 46 50	39 44 21	12 mi. e. State Capitol Bldg. Denver
CONN., Avon (Hartford)	WTIC	1040	50	32	72 48 20	41 46 35	8 mi. w. Travelers Insurance Tower
FLA., Gainesville	WRUF	830	5	55	82 20 30	29 38 45	1.5 mi. s.w. Court House Square
GA., Atlanta	WSB	740	50	20*	84 15 20	33 50 45	10.4 mi. n.e. center Atlanta
ILL., Addison (Chicago)	WMAQ	670	50	C	88 04 25	41 56 01	4 mi. n. Glen Ellyn
ILL., Downer's Grove (Chicago)	WLS-WENR	870	50	C	88 06 30	41 44 35	3.5 mi. s. Downer's Grove
ILL., Elgin (Chicago)	WGN	720	50	C	88 12 53	42 03 46	
ILL., Glenview (Chicago)	WBBM	770	50	8	87 49 46	42 05 42	18.3 mi. n.w. Chicago Loop
ILL., Mooseheart (Chicago)	WJJD	1130	20	59	87 37 35	41 55 00	35 mi. w. Chicago Loop
ILL., York Township (Chicago)	WCFL	970	1.5	40	87 59 14	41 49 09	
IOWA, Ames	WOI	640	5(D)	46	93 50 30	42 01 50	2 mi. w. Ames
IOWA, Des Moines	WHO	1000	50	12	93 20 40	41 39 08	14.9 mi. n.e. Des Moines
KAN., Milford (Abilene)	KFBI	1050	5	47	96 42 40	39 09 40	10.5 mi. n.w. Junction City, Kan.
KY., Jeffersontown (Louisville)	WHAS	820	50	12	85 34 40	38 12 10	12 mi. s.e.e. center Louisville
MD., Pikesville (Baltimore)	WBAL	1060	10(D)	42	76 44 00	39 21 40	6.5 mi. n.w. center Baltimore
	WBAL	760	10	S (Synchronized with WJZ Bound Brook, N. J. at night)			
MASS., E. Springfield	WBZA	990	1	S	72 33 00	42 08 00	5.1 mi. n.e. center Springfield
MASS., Millis (Boston)	WBZ	990	50	8	71 20 03	42 11 01	10 mi. s.w. center Boston
MASS., Saugus (Boston)	WHDH	830	1	56	70 59 40	42 26 15	
MICH., Detroit	WJR	750	50	2	83 15 00	42 10 07	16 mi. s. Detroit
MINN., Anoka (Minneapolis)	WCCO	810	50	25	93 19 02	45 10 01	2 mi. s.e. Anoka, Minn.
MO., Kansas City	WHB	860	1(D)	57	94 35 49	39 07 54	0.25 mi. n. Missouri River
MO., St. Louis	KMOX	1090	50	C	90 20 42	38 27 36	13.7 mi. from City Hall St. Louis
MO., St. Joseph	KFEQ	680	2.5(D)	44	94 52 10	39 46 32	1.0 mi. n.w. St. Joseph, over Mo. River
NEB., Lincoln	KFAB	770	10	8	96 41 40	40 49 41	
N. J., Bound Brook (New York)	WJZ	760	30(D)	28	74 50 50	40 55 20	1.5 mi. s.e. Bound Brook
	WJZ	790	30	(Synchronized with WBAL Baltimore at night)			
N. J., Carteret (Newark)	WOR	710	50	11	74 14 54	40 35 46	1.5 mi. w. Carteret on Rahway River
N. J., Wayne (New York)	WABC	860	50	25*	74 17 12	40 55 30	6.1 mi. n.w. Paterson N. J.
N. M., Albuquerque	KOB	1180	10	37	106 37 52	35 11 52	8 mi. n. Albuquerque
N. Y., Bellmore (L. I.) (New York)	WEAF	660	50	20*	73 31 49	40 41 07	
N. Y., New York City	WNYC	810	1(D)	39	74 05 55	40 42 22	Western end Brooklyn Bridge N. Y. C.
N. Y., Rochester	WHAM	1150	50	21	77 26 55	43 00 12	14 mi. s.e. Rochester 2 mi. n. Victor N. Y.
N. Y., S. Schenectady	WGY	790	50	17	74 00 35	42 47 57	4 mi. w.s.w. Schenectady, N. Y.
N. C., Charlotte	WBT	1080	50	42	80 55 28	35 07 52	8 mi. s.s.e. Charlotte
OHIO, Brecksville Vil. (Cleveland)	WTAM	1070	50	41	81 37 22	41 16 50	
OHIO, Mason (Cincinnati)	WLW	700	500	C	84 19 50	39 21 05	22 mi. n.e. Cincinnati
ORE., N. Portland	KEX	1180	5	45	122 41 15	45 36 22	5.5 mi. n. business dist. Portland near Columbia River
PA., Newtown (Philadelphia)	WCAU	1170	50	27	75 24 50	39 58 30	12.8 mi. w. City Hall Phila.
PA., Saxonburg (Pittsburgh)	KDKA	980	50	C	79 49 00	40 43 53	23.5 mi. n.e. Pittsburgh
PA., Whitemarsh Twsp. (Phila.)	KYW	1020	10	22	75 15 00	40 06 25	
S.D., Sioux Falls	KSOO	1110	2.5	45	96 45 30	43 32 20	3 mi. w. Sioux Falls
TENN., Franklin (Nashville)	WSM	650	50	C	86 47 32	35 59 50	
TEX., Dallas	KRLD	1040	10	46	96 51 12	32 54 18	
TEX., Grapevine (Ft. Worth)	WBAP WFAA	800	50	15*	97 01 35	32 55 04	11 mi. n.w. Love Field Dallas
TEX., Selma (San Antonio)	WOAI	1190	50	25	98 18 35	29 34 45	
UTAH, Saltair (Salt Lake City)	KSL	1130	50	25	112 06 03	40 46 30	
VA., Mechanicsville (Richmond)	WRVA	1110	5	37	77 22 43	37 36 10	5.5 mi. n.e. Richmond on edge Chickahominy Swamp
WASH., Seattle	KJR	970	5	31	122 18 30	47 47 15	10 mi. n. Seattle

Electronics, February 1936

Notes: **Name of town** is government listing. The symbol **(D)** indicates daytime operation only; all other stations operate more or less continuously from 6 a.m. to 12:30 midnight local time. **Interference:** the higher the interference rating the more likely the station will be interfered with by other stations on same channel. *Stations known as interference rating higher than 40 should be used with caution.* *No interference at night. **C** indicates no interference (clear channel). **S** indicates the station operates synchronously with another station; *signals from such stations should be used with extreme caution.* **Other abbreviations:** mi. = miles, n. = north, w. = west, s. = south, e. = east.

O J Whitney, New York charter operator and Beechcraft distributor (left), and Burnham Litchfield of Fairchild Aerial Camera Company. Below: A welcome in Havana.

Selling South America



WHEN O J Whitney and Burnham Litchfield took off from Miami on Jan 5 and headed the nose of their Beechcraft southward, they had two principal objectives: (a) to reciprocate the visit on the part of fifteen representatives of countries in Central and South America in October, 1935, and (b) to demonstrate to the countries of Central and South America certain of the latest items in American flying equipment. No mere order-taking junket was this, for the route that they had mapped out for themselves lay over some of the roughest and most dangerous flying country in the world. The several flights in themselves over water and over high mountain ranges, demonstrated as nothing else could have done, their confidence in the equipment they had to sell.

The trip was a joint effort on the part of several equipment manufacturers, a forerunner perhaps of the type of selling that seems best adapted to the development of South American markets. The ship that was selected was a Model B-17 Beechcraft powered with a 225 hp Jacobs engine. A Fairchild-Kruesi radio compass (see AVIATION, May 1936 p 24), was installed and extensively used for navigation. Several Fairchild aerial cameras including the CG 16 machine gun type and the K3B and FH general purpose type were carried along. Other equipment included engine accessories by Eclipse, propeller by Curtiss, finishes by Merrimac Chemical Co, tires by General Tire Co, instruments by Pioneer Instrument Co. For structural material, steel tube was

furnished by Summerill, aluminum by Aluminum Company of America, wing fabrics by Suncook Mills, and cabin upholstery by the Laidlaw Co. Pittsburgh Plate furnished cabin glass. Oil was supplied by Standard.

The 10,000-mile tour wound up in Rio de Janeiro where the ship and its equipment were delivered to several customers. Altogether 21 stops had been made in twelve different countries. The long and arduous trip had been made without a single equipment failure throughout.

Altogether the trip cost about $8,500. Its total returns have not yet been completely evaluated but as an indication, two Beechcraft were sold in Peru, five in Colombia, and a cash offer was made for three more in Buenos Aires. Merrimac Chemical is reported to have received a substantial order for dope for the Brazilian army. Incoming orders such as these will, for many months reflect the wisdom of actually taking American products into South American markets and selling them.

The days are long since passed when equipment manufacturers can consider the countries to the south of us as a convenient dumping ground for obsolete equipment. Whitney and Litchfield found that government officials throughout Latin America were keenly aware of aeronautical developments in the United States and elsewhere. All of them know what they want and are buying carefully with their particular requirements well in mind. They learned their lesson during the years immediately following the war of 1914-1918, when certain European nations unloaded large blocks of surplus equipment and supplies.

Like the well-known Missourian, now they have to be shown, and there is no better way of doing just that than to load up a ship with American products and demonstrate it on their home grounds.

Coffee from the Clouds

Some coffee manufacturers sell by radio show boats, others by dating their containers, but La-Touraine uses airplanes and derives publicity by pouring its coffee over troubled waters.

By Adriel U. Bird
President, LaTouraine Coffee Company, Inc

TIME: Midnight, February 9, 1936. PLACE: Living room in the Wincapaw residence in Boston. Grizzled Bill Wincapaw sits at ease chatting with Mrs. Wincapaw—

MRS. WINCAPAW (yawning) "Well, I think it's time to go to bed."

BILL "I will be with you right after this next news broadcast."

THE RADIO "Great anxiety is felt for the seven C C C youths who drifted away on an ice floe near Brewster late this afternoon. Although the Coast Guard has been organizing a thorough search for them, no word has been received at a late hour tonight" - - -

BILL "I am going to the airport. Will you call them before you turn in and ask to have the ship ready? Good-night."

The rest of the story is history. The LaTouraine Coffee Bellanca Airbus cruised over the pack ice area all night, keeping in two way radio communication with the Department of Commerce station at East Boston Airport and refueling three times. Early dawn revealed the refugees huddled in two groups on their respective ice floes. Captain Wincapaw dropped cigarettes and milk chocolate (he would have dropped coffee if it could have helped), guided an army bomber with blankets and clothing to be dropped on the spot, and then led the Coast Guard Cutter Harriet Lane through jagged ice floes to the rescue.

Wincapaw thought his work was done but it wasn't. A news photo company wanted a ship to rush the rescue films to New York so he gassed up the Bellanca once more and took off for Newark. But none of this has to do with dropping coffee which is one of the principal functions of the La-Touraine Bellanca.

Most recent opportunity to pour coffee over troubled waters occurred during the devastating spring floods. Captain Wincapaw didn't restrict his activities to the New England area, however, but covered Pittsburgh as well. And he didn't restrict his cargo to coffee. On one trip he carried a ton load of butter, lard and bread for Nashua, N. H., and Springfield Mass. Later the same day he carried three tons of foodstuffs to Concord, N. H. Coffee of course was an inevitable accompaniment to each load. Early the following morning the Airbus flew from Boston to Camden, N. J., and took on a ton of coffee for Pittsburgh. After the delivery the ship returned to Boston, seats were replaced, and Governor Curley was taken for a survey flight over the inundated areas.

On Christmas, 1935, four days after the Airbus was delivered, it was impressed into service in the unique rites performed annually by Captain Wincapaw for the past seven years. The ceremonies are intended to express continuing gratitude to the New England lighthouses for their guidance on the many mercy flights he made while in charge of the Curtiss-Wright base at Rockland, Me. Lightkeepers and their families have learned to expect the annual visits and the Christmas packages dropped from the airplane. Last year 91 calls were made. Besides coffee, the packages contained cigarettes, newspapers, books, toys, chewing gum, magazines, and almanacs. The lighthouse folk were made happy and so were we. And the publicity was far beyond expectations.

These are the dramatic uses to which our plane has been put. Naturally we cannot always use our ship in emergencies. But we can always use it to build good will and for this purpose we fly 1,000 hours annually. We have many friends among the hotel and restaurant owners and when we know one of them is making a long trip we place the plane at his disposal. Executives of the Hotel and Restaurant Association are carried to and from their meetings. Hotel personnel in nearby cities are taken on frequent guest flights. Our own officers use the ship to fly between branch offices in Chicago, Syracuse, Philadelphia, New York and Miami. We feel that this service alone plus the natural advertising value fully justifies ownership of the plane.

The airplane also serves to coordinate newspaper and radio advertising. For example, we have formed Captain Bill Wincapaw's Flying Corps. In return for a label from a coffee can, a youngster is given a picture of the plane and a pair of wings. Thus we are advancing aviation as well as reflecting favorable advertising upon our product.

More than a year ago, we used the Travel Air in an 'altitude guessing contest." At advertised hours, the plane flew over stated communities and those entering were to guess the altitude of the ship. A big circle was painted on one wing by means of identification. The response was tremendous. Our advertising on this venture was in proportion to its success and during the week of this contest we certainly had Greater Boston in an air-minded mood. Prizes in this contest ranged from cash to flights in the Travel Air.

At present we have two ships, a Travel Air and a Bellanca Airbus. The Travel Air was bought in 1933 from Wallace Beery and last year we outgrew it and bought the Cyclone powered Airbus. We need only one of these ships and are seeking a market for the older plane.

We do not attempt to make our airplanes flying billboards. Instead we paint the words "La Touraine Coffee" in dignified lettering on the fuselage sides and add our trademark—a steaming cup of coffee. The lettering is not large enough to be read from the ground when the ship is flying at customary altitudes, but it attracts wide attention at airports and appears in pictures taken of the celebrities who fly with us.

Our airplane does not stay very long in one place. We believe in keeping it in almost constant use. Here is what it costs us. (The following operation figures have been recorded on La Touraine Coffee's Wasp Travel Air, since no figures are yet available on the Airbus. These figures are based on the eighteen month period ending Dec. 1, 1935, during which 1,318 hours were flown. They do not include insurance or pilot's salary.)

Gas 38,299 gals. at $0.25	$9,572.50
Oil 6,854 quarts at $0.35	1,712.90
Storage	1,465.06
Labor	2,039.41*
Parts	1,073.64
Hotel	806.08
Meals	536.90
Ground transportation	634.13
Tips	226.05
Telephone and telegraph	276.14
	$18,341.11

*Since acquiring the Airbus LaTouraine has a full time mechanic assigned to the ship.

Possibly you business men who read these figures will think they constitute a pretty big bill. We feel that it is money very well spent. It is my sincere hope that you will give serious thought to the prospect of using airplanes in your own business. In many instances I suspect that they can be applied advantageously. And remember, I get no commission from selling airplanes.

Isolation, devastation—and coffee dropped from La Touraine planes make drama and publicity.

Winds Over Langley

A 500-m.p.h. wind tunnel was among items demonstrated by the National Advisory Committee for Aeronautics at its Eleventh Annual Aircraft Engineering Research Conference.

No hint for aerodynamically inclined here is the dome-shaped structure in the center of the 500 m p h tunnel It houses the test chamber Its shape was dictated by the fact that when the airblast is passing through it the internal pressure drops to that of an altitude of 12 000 ft above sea level It takes this foot-thick, steel reinforced "egg shell" to resist collapse.

VISITORS at Langley's annual conferenees invariably end their day in the Chamberlain Roof Garden with tired feet and with tongues hanging out, but few have ever failed to agree that they have been amply repaid for their efforts Dr. Ames, Dr Lewis and their associates have a way of pulling rabbits out of hats that is well worth watching. (At this juncture Oswald, the office boy, arched his evebrows Right, Oswald! We did mean elephants for this year's offering the 500 m p h wind tunnel is certainly more elephantine than rabbit-like)

Housed in massive reinforced concrete with passages completely lined with steel plate, this latest piece of research equipment is capable of producing a 500-m p h blast of air across an 8-ft diameter test section With relatively large models at speeds in excess of present world's records or the terminal velocity diving speed of the most modern airplanes, Reynolds Numbers have been pushed well into the full scale range One electric motor of 8,000 hp housed in a building outside the tunnel drives a 16-ft diameter propeller through a long connecting shaft Air flow is straightened out by countervanes immediately aft of the propeller and by deflector vanes in the four corners of the closed channel Temperature control was a major problem as will be realized from the fact that the whole 8,000 hp eventually goes into heating the comparatively small volume of air in the circulation system The present cooling system however, is able to maintain the air blast at practically outside temperatures when the tunnel is operating at full speed A six component balance is installed to measure the forces which may vary in magnitude from drag values of a fraction of a pound at low speeds to lifts upwards of five tons at high speeds Visitors saw the tunnel in operation, measuring the difference in drag of a metal wing of two foot cord, with and without exposed rivet heads

Unfortunately, due to the fact that a great deal of the work carried out at Langley during the past year was at the request of the Army and Navy, detailed reporting of results is impossible Here we must confine ourselves simply to an outline of the type of work in progress, leaving the reporting of the results to the publications of the committee, if, as and when they may be released

Tapered wings for fast planes

In aerodynamics a great deal of progress has been made on the design of low drag, tapered wings for high speed airplanes The variable density wind tunnel has been engaged in the study of reduction of wing drag and of low-drag combinations of wings and fuselages Special attention has been paid to fuselage shapes and to the development of a new wing root fillet

Wing section shapes have been developed that have exceedingly low drags. Many modern and efficient airplanes now employ wing sections such as the N A C A 23012 Much of the work of the past year has been to apply the data on these improved wing sections to the design of the best possible wing Many factors must be considered; the wing must develop high lifts so that small wing areas may be employed, resulting in small surface-area skin friction the wing must not lose lift near the tips when it stalls so that a dangerous roll will develop in flight and finally, the structural weight of the wing must not be excessive

Smoke flow studies of the boundary layer have made the conditions for laminar and turbulent flow better understood If the character of the boundary-layer flow over the wings of a modern airplane could be controlled so that laminar flow could be maintained, the drag of a wing, ordinarily 550 lb. might become 100 lb.

On an airplane in flight the boundary-layer flow may be lammar over the forward part of the wing, but it usually changes to turbulent flow before progressing far along the surface If this transition can be prevented or delayed tremendous reductions in drag will be accomplished The transition on a full-scale wing occurs in a distance of about 3 in and in order to study this transition this small section of the wing has been expanded ten times in the smoke flow wind tunnel, and a demonstration was given showing the transition actually occurring There were demonstrated also preliminary results showing changes in flow conditions to hasten or delay transition

Work was reported on the efficiencies of propellers operating at high tip speeds indicating a definite improvement in the data available for selection of blade sections For high altitude, high speed airplanes the trend is toward large diameter slow turning propellers

The problem of the multi-engined airplane with one engine dead was studied and the relative merits of multiple vertical tail surfaces and 'toed-out' nacelles considered

One of the most interesting shows was put on in the vertical spinning tunnel (described last year) Of chief interest was the demonstration of the spinning characteristics of a modern low-wing monoplane and also of a radical design such as the Weick or the Hammond

Gust loads have been studied both in full scale transport flight and in the laboratory Work was also continued on low-speed control devices, including flaps, slot-lip ailerons, etc , described last year.

The "tricycle" type of landing gear has come in for its share of attention. Laboratory models for the testing of castering stability or shimmy were demonstrated.

Major interest in structural problems centered around a study of the effect of stiffeners in monocoque construction

Of timely interest were the airship researches in the full scale tunnel Loads on fins and rudders were investigated and found to be astonishingly high Also studies of forces involved in handling large airships on the ground indicated the magnitude of forces involved. An airship the size of the Macon moored at the nose and yawed at an angle of 60 deg to a 20 m p h wind, experiences a lateral load of the order of 65,000 lb

Propeller and lift

Tests on effect of propellers on high lift of wings were reported It was indicated that for a ship of the modern type with nacelles in the leading edge of the wing the maximum lift coefficient on the wing might be increased from 1 69 to 2.03 with full power on as compared with power off.

In the towing tank an interesting demonstration of the use of a hydrofoil in connection with seaplane hulls was made A single hydrofoil fitted just ahead of the main step on a seaplane hull indicated a reduction in water resistance of some 25 per cent The hydrofoil idea is far from new but it is being revived as a possible means of aiding heavily loaded seaplanes to leave the water. Of interest also was the study of optimum shape for wing tip floats, also a comparison of a hull with exposed and with flush riveting

Cooling and cowling of aircooled engines has come in for a good deal of attention The NACA has developed a new type of nose cowl of a radically different type which looks promising

In the engine laboratory interest centered around diesel problems On display was a single cylinder high speed engine with the NACA displacer form of combustion chamber which is operated at a power output of 51 hp per cu in as compared with the .55 hp per cu in. obtained from some of the latest 1,000-hp gasoline driven aircraft engines On exhibit also was a glass cylinder engine for studying flow conditions in diesel cylinders, also a new type of fuel flow-meter developed by the laboratories reported to be accurate within 1 per cent for flows between 60 and 600 lb of gasoline per hour.

China Spreads Her Wings

歐亞中國

Commercial air services open up new paths for trade in the Far East. The second of two articles.

By Harrison Forman

MUCH like our own Rocky Mountain country is the terrain in the northwest of China. Ragged ranges stretch for endless miles, with mean elevations of 10,000 to 14,000 ft. above sea-level, and with treeless, loess-soiled plateaus and deep valleys

Modern transportation facilities—roads and railroads—are yet a thing of the future for China's great northwest. In consequence, a trip from Shanghai 2,000 miles to Lanchow—capital of the province of Kansu, sandwiched between the desert sands of Mongolia's Gobi and the wind-swept plateau of mysterious Tibet—by ordinary means of transportation may take anything up to two to three months of tedious and hazardous travel. Eurasia's airliners now cover this distance in one day on a bi-weekly schedule.

In a previous article (AVIATION, May, 1936) I noted that the Eurasia Aviation Corp. is capitalized for $3,000,000, of which two thirds is owned by the Chinese Government and one-third by Lufthansa of Berlin. And, as in the case of the China National Aviation Corp (45 per cent owned by Pan American Airways) the operations for Eurasia is entirely in the hands of Western personnel.

The present equipment of Eurasia consists of five single-engined, water-cooled, low-winged, all-metal Junkers (with accommodations for four passengers), and three tri-motored, low winged, all-metal Junkers (with accommodations for fourteen passengers) The big ships are powered with 650-hp. Hornets built by B M W under license from Pratt & Whitney. Their top speed however, is somewhat less than the bi-motored Douglass DC2's operated by CNAC. All the Eurasia planes are equipped with two way radio, and the pilots are in constant touch with ground stations while in flight Eurasia is bringing out a number of 10-place, bi-motored, water-cooled Heinkels (See AVIATION April, 1936, page 27), which will be placed into operation some time this fall

At present, Eurasia operates two major services out of Shanghai. The first, via Nanking, Chengchow, and Sian to Lanchow (with anticipations—when political conditions will permit—to continue northwestward via Suchow, Hami and Urumtchi, to Tchukuchak on the Siberian border, where the Russians will pick up mail and passengers and carry them westward to Europe); and the second, via Nanking, Chengchow, Sian and Hanchung to Chengtu (important capital of Szechwan province—also terminus of CNAC'S Yangtsze River line).

In addition to these two major lines, Eurasia also operates bi-weekly trips from Peiping to Chengchow, and from Lanchow across the Gobi Desert to Paotow. (The gap between Paotow and Peiping remains open because of political objections which the Japanese have raised against flights over the intervening Inner Mongolian and Manchukuoan territories.)

Until a few months ago Eurasia offered regular service from Peiping through Hankow to Canton in the extreme south of China, but because of the impetus of air travel to Chengtu, occasioned by Chiang Kai-shek recently taking a personal interest in the development of the province of Szechwan, Eurasia was obliged to transfer the planes from the little patronized north-south flight to the Shanghai-to-Chengtu service

The pilots are all old-timers fine clean cut fellows. They are captained by Wulf-Diether Graf zu Castell-Rudenhausen—the "Count," as he is affectionately called—who rates as one of the world's best fliers. I flew with him from Shanghai to Lanchow last February. He is a well educated fellow, keenly interested in Chinese culture and history. Though his English was as limited as my German, we got along nicely by speaking a jargon of the two languages.

I had wondered why I saw so many new faces amongst the Eurasia pilots, and what had happened to the boys I had known four years ago. The reason, the Count explained, was because pilots were usually reluctant to return for another trick after their three years contract was up, for fear of falling too far behind in aviation progress in the West. Logical, of course, with aviation making such rapid strides in development as it has these recent years

Toward Europe

While CNAC is primarily concerned with expansion and development in China and Far Eastern airline connections, Eurasia hopes eventually to establish overland international service from Shanghai to Berlin. And as soon as political complications — not only in China, but in Russia and Europe as well—may be ironed out, Eurasia is prepared to offer five to six days mail and passenger service from Europe to the Far East to compete with the present five to six weeks service by the water route.

Despite the discouraging obstacles that Eurasia finds constantly blocking the path of its development, the Directorate (six Chinese and three Germans) is very optimistic for the future of its Far East-to-Europe service

Eurasian business matters are ably managed by Mr. Djiu Dsung Li (a returned student from Germany), while operations and personnel management are under the direction of Mr. Richard Walter, vice-president of Eurasia and Lufthansa's representative.

Much of the present high state of development and efficiency in the Eurasia organization, however, is due to the pioneering efforts of Wilhelm Schmidt (with whom I flew on one of the earliest of scheduled flights to the northwest four years ago). Schmidt was later killed in Germany where he had gone to test-fly new equipment destined for the Eurasia service. Today, the flagship of the Eurasia planes is named the "Wilhelm Schmidt" in his memory.

There is one other commercial company operating in China—the Southwestern Aviation Company. This outfit is financed entirely by Chinese capital. Operating Stinsons with American-trained Chinese pilots, the SAC confines its activities principally to South China. With its hangars and shops in Canton, the line operates westward to Wuchow, Nanning, and Lungchow, also from Nanking to Kingchow via Pakhai; and Canton to Kingchow via Manning.

Though the SAC planes carry some passengers, the company is mainly interested in the freighting of opium—a profitable business which is excessively taxed en route when the stuff is transported overland

Japanese Influence

Since the establishment of Japan-fostered Manchukuo, Manchuria has been criss-crossed by air lines offering regular daily-except-Sundays service from Tokyo to Manchuli in Inner Mongolia. The equipment consists of Japanese built Fokkers—8-place tri-motor (Wright Whirlwind) F VIIb/3's and 6-place Bristol Jupiter powered Super-Universals. Pilots are all Japanese. Japan and Korea schedules are operated by the Japan Air Transport Co., Ltd.; while the Manchukuo lines are operated by the Manchuria Aviation

The Japanese in the very near future plan to extend their air lines from Manchukuo down into North China—at least as far as Peiping—and also from Japan to Shanghai and Formosa (Taiwan)

With surface forms of transportation in such a meagre state of development in the Far East, ordinary mail service is necessarily very slow. Since the inception of air service, however, the air mail has proven itself so efficient and of

西南

Top to bottom: A large proportion of Japanese air passengers are women. The mother (left) with Captain Paul Homaikoff, White Russian adviser in the N E Naval Air Service at Tsing Tau, China. Crew for one of Eurasia's single engined Junkers planes. A Fokker Super Universal passenger plane at Tokio Airport.

actual dollars-and-cents-saving value, that it has today become almost indispensable to native and foreign merchants in the Far East. And no wonder, when important letters, documents, valuable express, spare parts, etc., can be flown over flooded, famine or bandit infested areas to points in the far interior in as many days by air mail as it takes weeks—or even months—by surface transportation.

Air mail rates vary with not only the distance traversed but also the particular point to which the letter or parcel is destined—gaged, of course, by relative volumes in air mail poundage. The following data have been compiled from the latest corrected information obtainable from the Chinese Post Office and from the offices of the several companies operating in the Far East.

In addition to the ordinary postal rate of 5 cents (Chinese) per unit of 20 grammes, the following rates are in force. (Rates are given in Chinese cents. The Chinese dollar has 100 cents. One American dollar is equal to approximately $3.30 in Chinese currency at the present rate of exchange. Thus, 5 cents in Chinese money is equal to about 1½ cents in American money.)

Letters. For every 20 grammes or fraction thereof, and for every 1,000 km., 25 cents.

Postcards. Single for every 1,000 km., 25 cents. Double for every 1,000 km., 50 cents.

Newspapers. For every 50 grammes regardless of distance, 15 cents.

Printed Matter, Samples, Business-Papers. For every 20 grammes or fraction thereof, and for every 1,000 km., 15 cents.

The "Count" (left) with his copilot, Herr M. Wollweber.

Air Freight

Air freight is carried at the rate of 1½ per cent of the full passenger fare to the point of destination, for each kilogram. (One kilogram is equal to approximately 2.2 lb.) Passenger fare rates average about 10 cents (American) per mile.

Special or precious articles which require extra care and precaution in handling are charged at the rate of three times as much as ordinary parcels. Fifteen kilos (about 33 lb.) of luggage may be carried free on each ticket. Excess baggage is assessed at the above-mentioned rate of 1½ per cent of the full passenger fare as shown on the passenger's ticket.

Air mail and air freight charges on the Japan Air Transport and Manchuria Aviation Co. lines are approximately equal to those of the lines operating in China proper. Passenger fare rates, however, are considerably cheaper—averaging about 4 cents (American) per mile.

Flagship of Eurasia Aviation Corporation, the Wilhelm Schmidt.

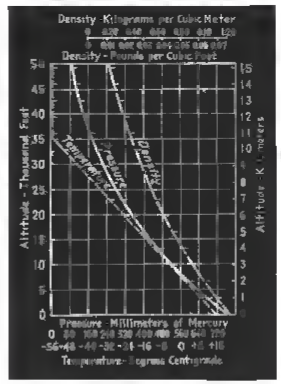
Utilizing China's Air Services

It is noteworthy to observe here how little up-to-date knowledge of air mail and express rates in the Far East is available in the larger tourist and commercial bureaus, international express companies' offices and even our own Post Office. Of course, one is told with a shrug of the shoulders that such information would be useless anyhow, since Chinese air postage is unavailable outside of China. Still, American and European manufacturing and merchandizing firms (mail-order houses, oil companies, motor car manufacturers, etc.) who do many dollars worth of business with merchants and individuals far up in the interior of China would gain much in materially speeding up correspondence and shipments by making arrangements with consular officials, Chinese postal authorities, or—if they have them—their own representatives in the big port cities, for the trans shipment via the air services of parcels and mail destined for away-from-the-coast points.

Air transportation in the Far East is becoming almost as reliable as here in the United States, and passengers, mail and express receive the same considerate and careful treatment and handling. There is no reason, therefore, why these services should not be utilized to dollars-and-cents advantage by American business concerned with the Far Eastern market as much as business here has come to recognize the practical value of our own air transportation services.

It is difficult to understand why the big steamship companies, like the Canadian Pacific, the Dollar Lines, Nippon Yusen Kaisha, and others operating passenger services to the Far East, do not get together with the air transport companies out there and offer tourists and travelers special combined rates for ship and air travel on a planned tour. Thousands of tourists cross the Pacific annually "for a trip to the Orient", yet all that most of them see of the Far East are the big port cities. Few venture outside the immediate districts of the Treaty Ports.

Of course, slow, uncomfortable, and perhaps even hazardous surface transportation will discourage travelers from venturing very far inland. Yet with air services today bringing fascinating points far up in the interior—perhaps weeks and months distant by surface transport from Shanghai—now only a matter of a day or two away from steamship piers, a whole new field for travel exploitation awaits only recognition and enterprise.



Standard atmospheric chart.

A study of the use of oxygen at high altitudes

Toward the Stratosphere

With transport operators looking toward high altitude operation for economy, the need of supplying air of proper chemical and physical characteristics to passengers and crew is becoming more and more acute

By James E. Sullivan
Bureau of Aeronautics, Navy Department

UNDER normal breathing conditions, inspired air is taken into the lungs where a part of its oxygen is absorbed and carried by the red corpuscles of the blood stream to the various tissues of the body. The quantity of oxygen which the body requires varies. When one exercises, his system consumes energy which in turn demands an increased supply of oxygen. The more strenuous the exercise the greater the quantity of oxygen required.

Normal air is composed (by volume) of the following ingredients:

Nitrogen	approximately 79.03 per cent
Oxygen	approximately 20.96 per cent
Carbon dioxide	approximately .04 per cent

Expired air varies in composition with the depth of expiration and with the composition of the air inspired. Under normal conditions the expired air contains in volume per cent: 79 per cent nitrogen, 16.02 per cent oxygen, and 4.88 per cent carbon dioxide. From the above it will be noted that but approximately 20 per cent of original oxygen content of the air is absorbed by the body, the remaining 80 per cent being wasted upon exhalation.

The respiratory system takes care of these varying needs of the body depending on the amount of carbon dioxide in the lungs. It is the CO_2 which stimulates respiration. Normally, the air in the lungs contains about 5.6 per cent CO_2. If this percentage increases (which it does when a person exerts himself) the rate of breathing increases. It is a common practice to stimulate the respiratory center of persons who have ceased to breathe or who breathe lightly, by administering carbon dioxide together with the oxygen. Recent tests indicate that helium is also of decided value in stimulating the respiratory center. An excess of carbon dioxide, however, (between 8 and 10 per cent) will cause distress and ultimate unconsciousness. As a result of studies carried on in Germany, Professor Hans Winterstein states that carbon dioxide should be carried along for high altitude flying as well as oxygen. He maintains that the decrease of the carbon dioxide in the system which causes subdued breathing is an important factor which should not be neglected.

The only apparent advantage of breathing air over breathing pure oxygen is that air can be breathed longer without harmful effects. A person cannot breathe 100 per cent pure oxygen indefinitely without injury. The exact time limit remains a matter for further research.

Pressure effects

At sea level, air is under a pressure of 14.7 lb. per sq in. which decreases with altitude. The decrease is not proportional to the change in altitude, for the rate of decrease diminishes as altitude increases. The volumetric composition of the air is the same, however, regardless of the altitude. Further, while the partial pressures of the oxygen and nitrogen have a constant ratio, the *pressure* of the oxygen in the air diminishes in proportion to the atmospheric pressure.

It is the opinion of many eminent physicians that the capacity of the blood to absorb oxygen depends on the external pressure on the body. They state that a deficiency of oxygen, such as is encountered at high altitudes (40,000 to 45,000 ft. and above) cannot be rectified merely by supplying oxygen to the lungs, for the blood will not absorb it due to the low pressures on the body. The theory is advanced that the essential factor involved is to make certain that the pressure within the body is not greater than that of the surrounding atmosphere. A number of persons who have conducted actual experiments under conditions of forced breathing do not concur on this point. It is contended by some that regardless of the atmospheric pressure a continuous supply of oxygen to the lungs is all that is necessary.

Lieutenant Soucek, in his report of his altitude record breaking flight, pointed out that at an altitude of 43,166 ft. he experienced no pain or physical trouble of any description. It is maintained by many that the reason he did not experience physical discomfort was because he did not remain long enough at this altitude. His apparatus was of the conventional gaseous type but included a hot water bottle arranged in such a way as to maintain a certain amount of pressure on the oxygen delivered to the mouth.

The altitude at which it is advisable to begin using oxygen depends upon the individual. No two will react exactly alike. Accordingly, one should not wait until he needs oxygen before he seeks a source of supply. The supply should be functioning well in advance of that time. Practical flight tests have demonstrated the prudence of utilizing oxygen at altitudes as low as 15,000 ft. Some may need it at lower altitudes, others may not need it at even 20,000 ft.

Oxygen deficiency is usually preceded by a feeling of exaggerated self confidence, but when the condition itself arrives it may come in a hurry and

without warning. Paralysis of the muscles, impaired judgment, loss of hearing, memory and vision are the symptoms. A serious deficiency of oxygen will result in unconsciousness and, if the victim is not revived within a reasonable time, death will result. A prompt return to conditions approximating normal atmospheric pressure is the proper treatment. The writer recalls a personal experience in which his oxygen supply was inadvertently cut off. He realized the need of oxygen but neither arms nor legs would respond to the will to do something about it, although it involved mere bending over and making a simple connection.

Oxygen apparatus

There are two types of oxygen apparatus in common use at the present time, the liquid and the gaseous. The former uses liquid oxygen which is vaporized and thus gasified before it is used. This system is not entirely satisfactory, for it presents liquifying and stowage problems of considerable magnitude because of evaporation losses. The gaseous type of apparatus is simple in nature and consists essentially of storing oxygen in a steel cylinder under a pressure of approximately 1,800 lb. per sq in., and reducing the pressure and regulating the supply by means of a combination reducing valve and regulator prior to taking it into the lungs. In some systems a flow meter is used to indicate the rate of flow of the gas, and it is also the practice in some cases to utilize an electrically operated heater to warm the gas to preclude the possibility of freezing in the system. For such a system it is recommended that the moisture content of the oxygen not exceed .02 per cent by volume to minimize the freezing hazard. Without a heater in the line there is danger in utilizing oxygen with a higher moisture content. While this means of using oxygen is not without its disadvantages it is simple and reasonably satisfactory. It is best to use a manually operated regulator or an automatic regulator equipped with a manually operated by-pass arrangement. Failure of the regulator could very easily result in a fatality.

In addition to the two fundamental methods of supplying oxygen to the body described above, several additional methods are practical, some of which as indicated, are believed readily adaptable to commercial flying.

(a) Pressure tight suit for pilot such as used by the late Wiley Post.

(b) Closed cockpit or cabin (not pressure tight) with oxygen supplies from within.

(c) Pressure-tight cockpit or cabin supercharged from the first stage of the engine supercharger.

(d) Pressure tight cockpit or cabin supercharged by an exhaust-driven supercharger.

(e) Pressure tight cockpit or cabin supercharged by an externally driven supercharger.

(f) Pressure tight cockpit or cabin supercharged from the discharge of the vacuum pump.

(g) Pressure-tight cockpit or cabin with oxygen supplied from within as required.

It is understood Wiley Post used his pressure-tight suit at altitudes between 25,000 and 30,000 ft. for several hours without suffering any ill effects with a pressure of 3 to 4-lb. per sq. in. on his body. This system, while usable, is obviously not satisfactory for commercial transport. Further, such a suit is bound to be objectionable from a pilot's point of view as the inflexibility of the joints, although much has been done to minimize this objection, would interfere with his normal duties in flight. The French are said to be doing considerable work on this phase of the problem, making every effort to provide flexibility at all joints.

Method (*b*) while usable at low altitudes (say 20,000 to 30,000 ft.) is not entirely satisfactory because of pressure deficiency at high altitudes. Tests on scheme (*b*) are being conducted and reports indicate that it will be a reasonably satisfactory, though not an economical means of supplying oxygen for commercial use of the altitudes at which transports are now operating. Such altitudes are considerably below the reputed danger range.

Supercharging the cockpit from the first stage of the engine supercharger has its limitations in that failure or malfunctioning of the engine would result in failure or a drastic reduction of the oxygen suppy. This objection could be taken care of temporarily by providing an emergency oxygen breathing apparatus (which would be necessary in the event of failure of any pressure-tight cockpit or cabin installation). Engine failure could be discounted, however, by the use of a supercharger operated independently of the engine. Further, it is believed that the full capacity of engine superchargers developed to date, or in immediate prospect of development, will be needed in the development of increased engine performance at high altitudes and should not be penalized by carrying the cockpit supercharging. As for the proposal to utilize the discharge from the vacuum pump for supercharging the cockpit, it is believed that such a scheme has possibilities, but that development of a supercharger operated independent of the engine would be less costly. The problems of obtaining a pump of adequate capacity and of purifying the air appear quite complex. The idea is, basically sound, however, and may be practical with the advent of more efficient pumps.

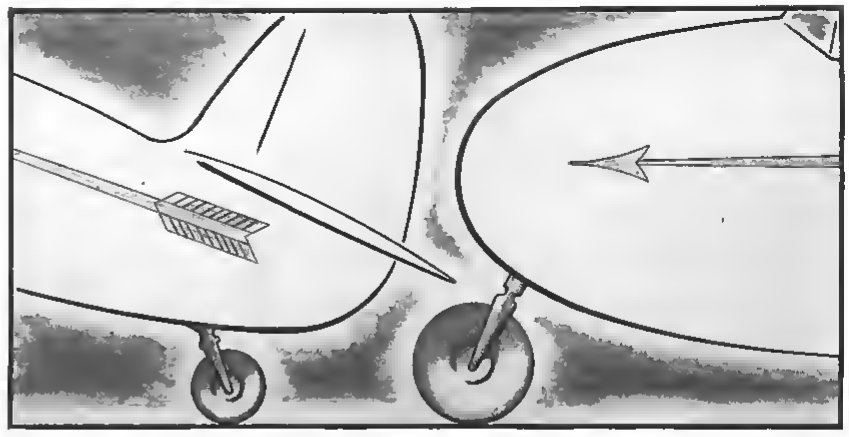
Of all the schemes listed above, the externally-operated supercharger and the admission of pure oxygen to a pressure tight enclosure from within, are considered the most practical and most readily adaptable for use. It is admitted that any pressure-tight enclosure is not without its disadvantages but it is still believed to be the most efficient physiological means of preventing oxygen deficiency. The use of such a scheme is one though which presents many problems. Carbon monoxide is readily absorbed by the blood stream and in view of its poisonous nature, even in concentrations as low as .015 per cent, every effort should be made to prevent the engine exhaust gases of which it is a constituent, from getting into the enclosure. In addition, special consideration must be given in the design of the structure and its component parts to withstand the internal pressure without leakage. Sealing of openings for the controls, instrument lines, piping, etc., must also be considered for this phase of the problem.

In any closed cockpit or cabin arrangement it will be necessary to provide means for absorbing the carbon dioxide of the expired air. This can be easily taken care of by the use of canisters containing an absorbent such as high purity soda lime. The amount to be used will necessarily have to be calculated for each installation involved.

What about the "bends"?

The question occasionally comes up as fliers become more and more "oxygen" conscious on the possibility of acquiring the "bends" in passing from one altitude to another, due to changing pressures. If it were possible to climb rapidly enough to prevent equalization of the pressures within and without the body it would be possible to acquire the "bends." The rate of climb, however, of the airplane of today is not so rapid as to be a hazard in this respect. There is no need for concern on the descent for in passing from high to low altitudes, or from low to high pressures, as increase in the pressure on the body does not produce "bends." The writer is familiar with a practical, though not planned, demonstration in a decompression chamber, in which the occupant dropped from a pressure of approximately 3 lb. per sq. in. (corresponding to an altitude of 37,500 ft.) to a pressure of 13.5 lb. per sq. in. which corresponds to an altitude of about 2,500 ft., in less than 20 seconds without ill effects. The only noticeable result was temporary loss of hearing for a period of approximately two weeks.

No one will question the advantages to be gained in flying at high altitudes on long hauls. To fly at such altitudes it is necessary that the body be supplied with ample oxygen. Whatever system is chosen should not be considered on the basis of cost, but only on efficiency, comfort and safety. It is believed that commercial flying in the upper limits of the troposphere or in the low limits of the stratosphere will demand the use of a pressure-tight enclosure.



Tail Wheel or Nose Wheel?

The author is a member of the technical staff of the Bureau of Air Commerce. He writes, however, as an individual engineer, personally interested in the question of a better landing gear arrangement.

By F. R. Shanley

THE "third wheel controversy," stirred up anew by the Bureau of Air Commerce program on small airplanes and by efforts of certain individual designers, has developed new interest in the design of that necessary nuisance, the landing gear. Another factor which has increased the importance of the problem at the moment is the possibility that blind landing will soon become a regular operating feature in air transport. In order to insure safety in blind landings it is necessary to eliminate any tendency of the aircraft toward ground-looping after contact.

A number of designers have done much to develop the subject. Mr. Fred Weick of the National Advisory Committee for Aeronautics in his recent articles in AVIATION (July, 1934, and January, 1936) and in his paper presented at the 1936 annual meeting of the Society of Automotive Engineers, has told how he has put the nose wheel landing gear to practical use on his W-1 airplane. Capt. Frank T. Courtney also discussed the subject in his article in AVIATION for December, 1935. Recent tests with the revised Hammond Model Y (AVIATION, May, 1936) have further demonstrated the practicability of the nose wheel arrangement.

The general characteristics of the front wheel type landing gear as covered in the articles referred to above may be summarized as follows:

1. Greater passenger comfort during landing and taxiing, due to airplane being level.
2. Prevention of nose-over. (This can be accomplished by proper design of the tail-wheel gear, however.)
3. Somewhat shorter landing run, due to the decreased lift and full application of brakes.
4. Longer take-off run on poor fields.
   (a) Unless the rear wheels are placed relatively close to the c.g. it becomes difficult to get the nose up. (NACA Technical Note No. 557 indicates that the shortest run on muddy fields would be obtained with the airplane at a constant high angle of attack.)
   (b) Propeller thrust and ground drag produce a couple tending to make the nose wheel "dig-in."
5. Difficult to get the rear wheels suitably located. (If they are too near the c.g. the nose will tend to bounce up when taxiing, if too far behind, the take-off is affected as noted in Item 4.) This problem would be still more acute in transport planes with a widely variable c.g. location.
6. The nose wheel requires relatively greater shock absorption (longer travel) and does not ride over obstacles as easily as the tail wheel.

The evidence seems to favor the conventional tail-wheel type which has found favor with designers for many years. The question therefore arises: does the natural ground stability of the front-wheel gear make up for its known disadvantages? But this question infers that the conventional gear is hopelessly unstable. Before going any further, then, the basic principles of ground stability, or the automatic prevention of ground looping should be considered.

Ground stability

If the effects of the vertical location of the c.g. are neglected, the whole problem can be simplified by considering only two wheels, as shown in Fig. 1. Such a figure can represent either a nose-wheel gear or a tail-wheel type, the only difference being in the fore-and-aft location of the c.g. If the airplane is con-

sidered to be landing in a cross-wind, its path relative to the ground before contact might be represented by the line V_a. A stable gear would cause the airplane to turn and head along its original direction of motion after contact with the ground. An unstable gear, however, causes the airplane to turn away from its line of motion, which it might do very sharply. The latter case is, of course, the well-known ground loop.

Looking again at Fig. 1, S_1 and S_2 represent the side forces acting on the wheels at contact. If the brakes are not applied, and if the ground force required to start the wheel rotating is at first neglected, the only appreciable friction loads that can be built up will have to act perpendicular to the wheels, or parallel to the axles. In any case, the problem of the two-wheel gear is simply to make the turning moment S_1d_1 less than S_2d_2. If this is done there will be an unbalanced moment about the c.g. which will tend to turn the airplane in the proper direction.

If the rear wheel is swiveled so that its side load S_2 cannot build up, there is nothing left to turn the airplane into the direction of motion. The best that could be done would be to swivel the front wheel also, in which case there would be no tendency to turn in either direction and the airplane would tend to continue along the ground in its original attitude, crab-fashion. If both wheels were prevented from swiveling the side forces would be roughly proportional to the weight on the wheels, and the turning moments would be roughly equal. There is always a tendency, however, for the vertical load on the front wheel to be increased by the moment due to the ground drag, so the value of the side load would be increased proportionately. This would give ground-looping tendencies, though they would not be as bad as those present when the tail wheel is swiveled.

There is also the possibility of hitting front wheel first (in the conventional type of gear), in which case the helpful effects of the fixed tail wheel could not act immediately. This might start a ground loop which would be difficult to control even after the tail wheel touched the ground.

It appears from the above that the tail wheel should be fixed and the front wheel swiveled. If this is done properly, the front wheel will refuse to build up any appreciable side load and will turn into the direction of the airplane's motion. Then all the helpful effects of the tail wheel side load will be completely utilized and the airplane will always turn itself into the direction of motion without assistance from the pilot. The next problem, therefore, is to arrange the front wheel so it will do what we want it to do, without also becoming independent and wandering around, or 'shimmying."

Effect of brakes

Before going into the question of individual wheel arrangement, it will be of interest to consider how the use of brakes will affect the picture. We have to consider actual three-wheel gears, as the differential use of the brakes enters into the analysis. Fig. 2 shows the conditions for the conventional gear. We have two side loads and two braking loads acting on the front wheels. By actuating the right brake only, the helpful turning moment Bkh_1 would be created. Since the moment arm h_1 is helpful and the arm d_1 harmful, the ratio of h to d should be large if the brakes are to be effective in preventing or stopping ground loops. From this it follows that, if the front wheels are moved forward, they should also be moved outward, along a line through the c.g.

One other feature is of interest in connection with brakes. If the front wheels are swiveled, but also braked, the resultant ground forces will tend to be along the direction of motion. This means that a side component will be built up even though the wheels are swiveled. Therefore the helpful effects of swiveling would be partially lost if the landing were made with locked brakes. In this respect the nosewheel type of gear has the advantage that the brakes are on the rear wheels, where side loads are desirable. Applying this line of reasoning in a different way, it appears that braking the tail wheel of the conventional gear would to some extent be equivalent to fixing it, possibly just as efficient if the same coefficient of friction against side motion could be built up. Incidentally, a thorough study of friction coefficients under various conditions of side and forward motion might indicate how tire treads could be modified to improve ground handling qualities. Offhand it would seem that the fixed tail-wheel tread should have annular (ring) grooves, while the fixed front wheels should have lateral grooves on the tread.

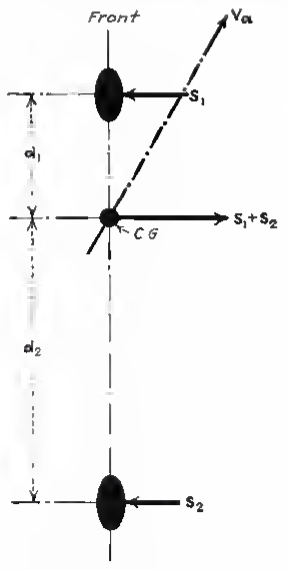


Fig. 1. Two-wheel gear landing with side drift.

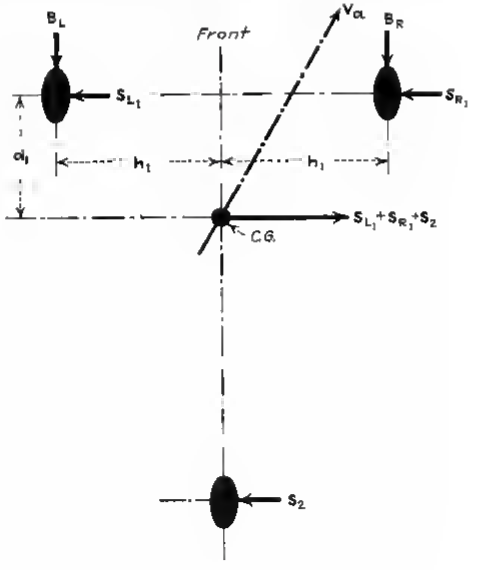


Fig. 2. Conventional gear.

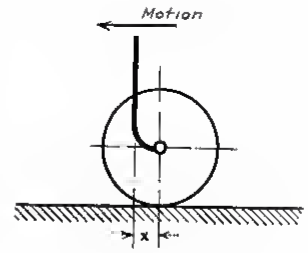


Fig. 3. Simple castering wheel.

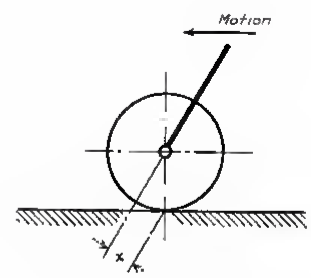


Fig. 4. Simple inclined swiveling wheel.

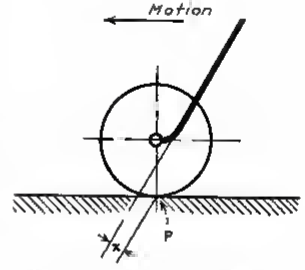


Fig. 5. Inclined and offset (front-wheel type).

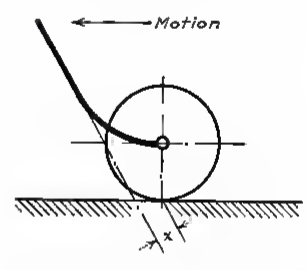


Fig. 6. Inclined and offset (rear-wheel type).

Wheel stability

In any case in which a swiveling wheel is to be used, the objectives are about the same, and the same basic principles will apply in all cases. Two main conditions must be provided for: (1) the wheel must respond to side forces so as to line up with the direction of the airplane motion; (2) the wheel must be individually stable, that is, it must not oscillate or shimmy.

To meet the first condition it is only necessary to be sure that the point of contact (this term is used to represent the centroid of the contact area) lies *behind* the swiveling axis. (*Behind*, of course, refers to the direction of motion.) Figs. 3, 4, 5 and 6 show various ways in which this can be done. These are quite obvious, although the arrangement shown in Fig. 6 and commonly used for tail wheels requires a considerable offset which might be overlooked. Incidentally, the arrangements shown will work about the same either for nose or for tail wheels. There may be other reasons why one type would be preferred in certain cases, such as the desire to keep the wheel base as long as possible.

The combined use of the inclined axis and the offset, as in Fig. 5, introduces some interesting complications which can be cleared up by a simple lay-out. Fig. 7 shows such a lay-out for an arrangement like that shown in Fig. 5, in which the wheel is assumed to be a disk of no appreciable thickness. First of all, the conditions without offset are investigated, these being shown by the heavy lines. By assuming different angular positions about the axis X-X and drawing the wheel in side view the successive points of contact are found at the lowest points of the several ellipses. When projected into the plan view of the wheel these points can be connected to show the travel of the point of contact. This process is then repeated for an assumed offset and the results are shown by the dotted lines.

The question of stability and balance will depend on the action of the ground forces in turning the wheel about the axis X-X. The two forces to consider are the vertical force V and the side force S. The latter can be considered as the component (perpendicular to the plane of the wheel) of whatever force acts on the wheel parallel to the ground. Obviously the other component (in the wheel plane) will have no turning moment arm about X-X and can therefore be neglected.

Likewise we can forget about the component V_x acting along the X-X axis and deal only with the normal component N. In the plan view this can be further resolved into two forces, of which only N_s is of interest. This force is illustrated in the enlarged plan view of Fig. 7.

Determination of forces

It is now apparent that when the wheel is slightly deflected from the plane of symmetry there are two forces which tend either to continue the deflection or to stop it. These forces are S and N_s and they act at the point of contact, which will lie on the lines shown in the projected view of Fig. 7. The force N_s, depending only on the ground reaction V, will be present at all times when the wheel is on the ground. (It will, incidentally, increase if the load V is increased due to landing or taxiing accelerations.) Force S, however, will depend on the relative velocity between the tire and the ground, on the load V, and to some extent on the angularity of the tire with the line of motion.

If the airplane is not moving, S will be negligible and the force N_s will tend to turn the wheel about the swiveling axis until it reaches a position of equilibrium. This will occur where the contact point (plan view) is such that the force N_s has no moment arm about the axis X-X. In the case of no offset, this position will be at 90 deg. deflection, that is, the wheel will tend to stand straight across the airplane when at rest. When there is an offset such as

in Fig 5 (see dotted lines in Fig 7) the angle of equilibrium will be something less than 90 deg, depending on the amount of inclination and offset. When the swiveling axis slopes upward and rearward, it appears to be impossible to get an arrangement which will provide properly for side forces and at the same time keep the wheel lined up with the airplane when at rest (It should be remembered that in this analysis the effects of the area of contact are being neglected These effects will often keep the wheel from swiveling when the airplane is at rest.)

Now if the airplane starts to move over the ground, the force S will be built up and will tend to turn the wheel back to the original position if the point of contact lies on the proper side The position of equilibrium will be reached when S and N_1 are equal This will depend on the inclination and offset, the airplane speed, and the braking (or rolling) friction of the wheel At slow speeds the position of equilibrium will probably be at some considerable angle to either side of the normal position. (There will also be a neutral position when the wheel is perfectly lined up with the airplane axis and the direction of motion, but this is not a stable position.) Without going any further, it seems that this condition would be highly conducive to shimmy, as the wheel in motion would tend to fluctuate from one neutral position to the other The only remedy would be to add some frictional damping which would require the wheel to do work in shimmying and would help it stay put

Shimmy

There are many more features which should be considered in dealing with shimmying The fact that the area of contact is not a point will have its effect. The fluctuating side load will tend to move the wheel (and the part of the airplane to which it is attached) from side to side This indicates dangers from side play and lack of lateral rigidity In addition, the principles of resonance and gyroscopic forces are brought into the picture by the rotation of the wheel But these things are beyond the scope of this analysis and may or may not be reducible to engineering terms.

If Fig 7 were to be redrawn for the arrangement shown in Fig 6, it would be found that the forces S and N_2 would both tend to make the wheel return to the normal position. This arrangement therefore appears to be the only inherently stable one and would probably not require any frictional damping unless shimmying were caused by lateral play of the wheel or structure.

The side loads due to ground friction will tend to line the wheel up with the direction of motion, while the "weight" loads will tend to line it up with the airplane itself, or at some definite angle with the airplane axis The first of these conditions is essential if the wheel is to be effective as a front wheel in preventing ground loops The second is not so important, but is seen to be a possible cause of shimmying if the "weight" stability axis does not line up with the airplane

Some form of spring return probably could be used to supply the additional centering moment required in the arrangement of Fig 5

Summing up

1 The ground stability feature of the nose wheel gear appears to be its most valuable asset.

2 The conventional tail-wheel gear can be made stable by swiveling the front wheels and by keeping the tail wheel fixed.

3 In any case a swiveling front wheel must have its point of contact behind the swiveling axis.

4 Sloping the axis upward and rearward introduces possible causes of shimmying which might be eliminated by "centering" springs and friction al damping

5 If the tail-wheel gear were made stable it would be advisable to land with brakes released until after the tail wheel had begun to carry some weight.

6 In a stable tail-wheel gear the ground steering might best be accomplished by steering the front wheels, leaving the tail wheel non-swiveling.

7 The ground stability of existing tail-wheel gears could be improved by:
- (a) Locking the tail wheel in landing
- (b) Braking the tail wheel in landing
- (c) Further separating the front wheels.
- (d) Increasing vertical travel of tail wheel so it would always tend to hit first; accompanied by softening the tail wheel shock absorber
- (e) Modifying tire treads to build up side loads more readily on tail wheel than on front wheels

Although the complete analysis of wheel shimmy probably ranks with the problem of wing flutter, it does seem that at least part of the contributing features could be eliminated by a careful study of the wheel installation, as described here. It is hoped that some of the work being done by the NACA will throw more light on the subject, which will become much more important if swiveling front wheels are generally adopted

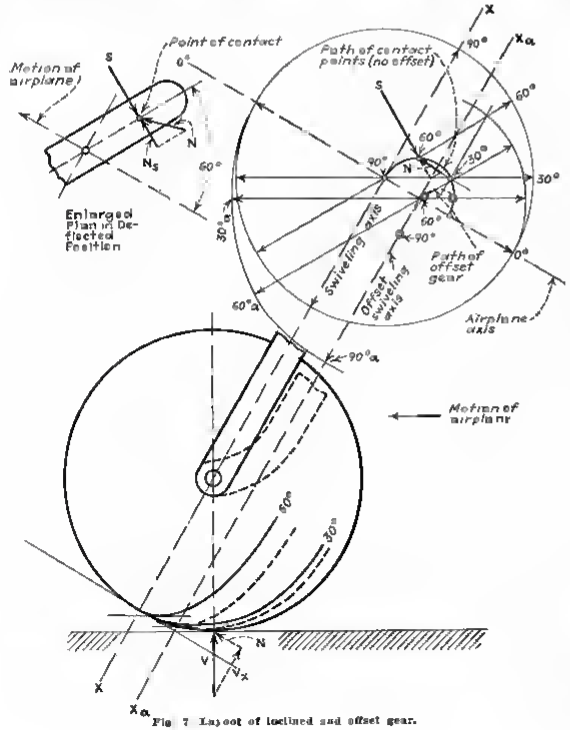


Fig 7 Layout of inclined and offset gear.

Editorials

AVIATION • ESTABLISHED 1916
VOLUME 15 NUMBER 6

WHERE IS THE RISTINE REPORT?

► It has now been four months since a report leaked out of Washington that Special Assistant to the Attorney General, Col. Carl L. Ristine, had submitted a brief to his chief on the Case of the Cancelled Contracts, Farley's masterpiece of 1934.

It had been commonly understood that the Department of Justice had been conducting its own investigation of the legality of the original air mail contracts, the circumstances surrounding their origin, and the charges that led to final cancellation. Rumor holds that the investigation has disclosed little to support the administration's claim of fraud and collusion and, more important, that little evidence exists to justify the branding of individual air transport operators as criminal and the debarring of them from their chosen profession.

The great mystery now is what has happened to Ristine's report? Not a word of its contents nor its whereabouts has been revealed. Perhaps it never existed at all. But the very least that the Department of Justice might do to clean up a situation that has begun to give off rather obnoxious political odors would be, first, to affirm or deny the existence of the report, and second, to publish the full facts. Withholding the report carries only one inference, that the findings did not justify the administration's action, that the administration is not willing to take the blame for an obvious miscarriage of justice. There is so much at stake that the air transport industry is justified in demanding as loudly as possible—Where is the Ristine report?

LARGE EGG

COMMONEST warning of conservatives concerns the placing of all one's eggs in one basket. Lighter-than-air enthusiasts have extended the limits of their risk somewhat beyond the bounds of the old adage. They now have all their hopes in one egg.

Lighter-than-air sentiment in this country has been at a very low ebb since the loss of the Macon. The fact that the Graf Zeppelin has been crossing and re-crossing the South Atlantic on regular schedules has made very little impression. South America is a long distance away. The Graf's crossings have become so commonplace that they have no publicity value any more and few people in this country are aware of her outstanding performance record. Now, however, all eyes are on the Hindenburg and the inauguration of its summer schedules has been attended by great blasts of publicity. Once again the country has suspended judgment on the airship as a commercial vehicle and is becoming more willing to reconsider past opinions in the light of this summer's performance.

A great deal has been learned about the technique of aircraft construction even since the days of the Akron and the Macon. But the biggest lesson yet to learn concerns the safe operation of airships. Therein is probably the key to German success. Elsewhere in this issue Dr. Karl Arnstein, dean of airship designers, shows that all inherent safety advantages and painstaking engineering may be easily nullified by improper operation. Greatest danger is in utilizing the airship on occasions or on missions for which it is not suited. Highest degree of safety can never be secured until "operators are freed from pressure to operate under conditions which for aerological, technical, or engineering reasons are not as safe as could be desired."

TOWARD MECCA

ONCE a year many a pious Mohammedan abandons his tents and cookes a pilgrimage to Mecca. There he stores up enough of inspiration and what-not to tide him over the next twelve months. Thus also the aircraft industry—every May for the last eleven years—has made its pilgrimage to view the wonders of the sacred city of the NACA on the shores of Chesapeake Bay.

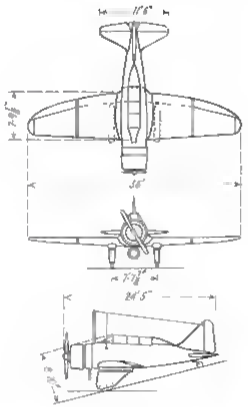
But followers of the Prophet do more than yearly obeisance at the shrine. Daily they prostrate themselves on the sands, faces toward Mecca, drawing at long range on the resources of headquarters.

Thus also for the aircraft industry does the NACA laboratory provide a continuous source of essential information throughout the year. The procedure to be followed in getting at it, however, is slightly more complicated than for our Arabian brethers. Seekers after knowledge must make the proper approach if they hope to get anywhere. With so much work going on for the Army and the Navy, orders against admitting anyone to the laboratory without proper credentials have been made very strict. A great deal of time, difficulty, and misunderstanding will be saved if prospective visitors remember to make application through the Washington office before going down the river.

Flying Equipment

Seversky Airplanes

Structural and design details of Army basic trainer and several other models are released



The Seversky BT-8 in flight (below) and on the ground (right) showing "disclerators" down. Three view drawing of the earlier trainer (above)

WITH the advent of high speed all-metal military tactical planes, it soon became apparent to the Army Air Corps that the specialized requirements of training demanded equipment more nearly resembling the airplanes that the student ultimately would fly. At about the same time, the Seversky Company offered a design based on the principles embodied in the earlier Seversky amphibian and, after the usual procurement formalities, received an order for 30 ships. The original training plane design was later modified in a few minor details and the final result is known by the designation BT-8.

Structurally, the BT-8 is similar to the earlier trainer described in the February, 1935, issue of AVIATION. The fuselage is of semi-monocoque type, with bulkheads pin-connected to extruded channel section stringers. An important point in the fuselage structure is the No. 4 bulkhead, located between the two tandem seats and, faired into a crashproof headrest. The headrest is shaped to the approximate contour of the student's head so that it does not interfere with the vision of the instructor in the rear seat. The No. 4 bulkhead also contains the loop antenna for the direction finding radio compass. Perfect reception is reported with this arrangement even when the cockpit canopy enclosure is completely closed.

To insure rigidity of the tail surfaces, fin and stabilizer are built integral with the fuselage structure and longitudinal balance is obtained by elevator trimming tabs. The fuselage rests on the wing and attachment is made by ten bolts. Chief structural elements are five metal box spars. Longitudinal corrugated alloy sheets are riveted along the top flanges under the skin and the lower surface is stiffened by transverse inverted U sections. Weight of the Seversky wing structure is less than 2 lb. per sq. ft.

Gasoline is carried directly in a portion of the wing structure that has been made liquid-tight. End walls and baffle plates of the tank area contribute to the strength of the wing. This arrangement not only provides a more effective use of material in the wing structure but simplifies maintenance. It is somewhat similar to the practice in the Martin 130 Clipper ship of carrying gasoline in a sealed-off portion of the hull structure below the flooring.

The wing gasoline tank feature has withstood two years of test flying and the principle probably will be extended in future designs to the entire wing panel structure in order to provide greater gasoline capacity and emergency flotation in the event of a forced landing on the water. A special type of patch has been designed to repair bullet holes in this type of wing in case of damage in military operation.

Like the previous model the BT-8 is equipped with "disclerators"—Seversky terminology for split trailing edge wing flaps. They are inboard of the ailerons and manually operated. The control mechanism is ball bearing mounted throughout.

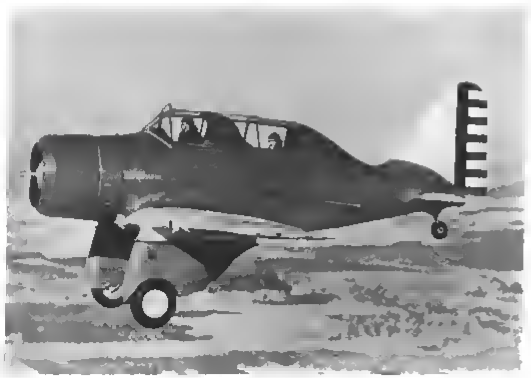
Landing gear is of the cantilever type with streamlined tires and wheels and hydraulic air and oil shock absorbers. Although it is not retractable, a complete dummy retractable gear mechanism, with all the necessary handles and warning signals, is installed in the cockpit for training purposes. Thus it is possible to train the student in the technique of handling a plane with retractable gear without the risk of a crash due to forgetfulness about dropping the wheels before landing. By the use of the Seversky twin float amphibian landing gear, the airplane can be converted into a seaplane or amphibian in less than an hour.

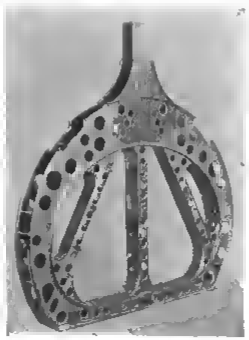
Three types of engines (R-975, R-985 and R-1340 Wright) are provided for in the design. Cowling is of the double venturi type.

Specifications of the BT-8 with 400 hp. engine are: length overall, 24 ft. 5 in.; wing span, 36 ft.; height overall, 11 ft. 7 in.; total wing area, 220 sq. ft.; weight empty, 2,992 lb.; useful load, 1,107 lb.; gross weight, 4,099 lb.; power loading, 10.25 lb. per hp.; wing loading, 18.6 lb. per hp.

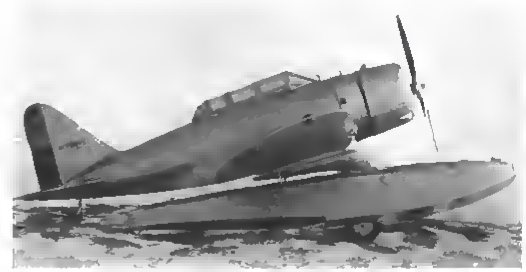
Structural principles of Seversky design have found application in several other models. Some have been built already, others are for the future. A three-place sport amphibian, a six-place amphibian and landplane, a ten-place transport, a two place pursuit and a two-place amphibian fighter are among them. Details of all these ships are not available but we are able to discuss several here.

The two-place Amphibian Fighter is available with either the Wright Cyclone F-53 or the Whirlwind 975E-3. It is of standard Seversky construction has the characteristic float type retractable landing gear. Span is 36 ft., length 28 ft., weight empty 3,205 lb. (Whirlwind) 4,035 lb. (Cyclone), and gross weight 4,600 lb. (Whirlwind) and 5,500 lb. (Cyclone). Maximum speed (Cyclone) is 260 m.p.h. at 11,000 ft. and 220 m.p.h. at sea level. With Whirlwind at sea level it is 175 m.p.h. at 2,200 r.p.m. and 150 m.p.h. at 1,950 r.p.m. Landing speed with flaps is 65-67.



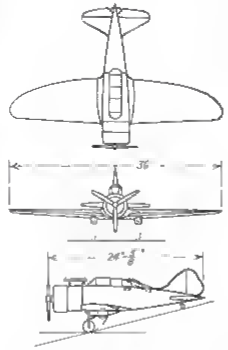


Above: Bulkhead No. 4 with headrest. Right: A portion of the wing structure



The two-place amphibian fighter—a modification of the first Seversky ship

The experimental two-place pursuit or observation plane



m p h. and cruising range 700-900 m p h.

Similar in design and construction is the two-place Pursuit or Observation plane with F-53 Cyclone engine. This model is a land plane with retractable gear and flaps. It has the same span but a shorter fuselage (length 24 ft. 8 in.) than the Amphibian Fighter. Weight empty is 3,600 lb and gross weight 5,300 lb. High speed is 280 m p h at 11,000 ft. Landing speed is 66.5 m p h with flaps, service ceiling 25,000 ft., and range, 950 miles.

For the future Seversky plans include production of the "Sky Yacht" (SEV 6A) a high performance six-place amphibian powered with the Wasp S-3 H 1 engine. The Sky Yacht will be somewhat larger than previous models, having a span of 45 ft. and a length of 32 ft. 4 in. A variation, the SEV 6J will be a landplane of similar specifications and dimensions with retractable landing gear. Both of these ships will embody the structural principles of the present models.

RCA Transmitters

An answer to the need for low-priced radio equipment

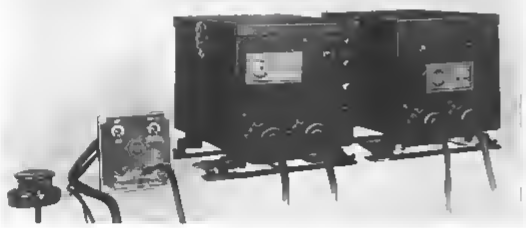
Not long ago we happened to be in Philadelphia and we dropped in to Dave Little's office to ask him what RCA was doing about the constantly increasing need for low priced aircraft radio equipment. He took us over to the airport and gave us a little preview of the equipment in a flight over Camden in the company's Stinson. The two transmitters that we saw have just become commercially available and we are now at liberty to discuss their details.

Lowest in price is the ABT-7 Model which sells for $332.20 complete. The ABT-7 consists of three units—the transmitter, vibrator power supply, and control panel. With it, it is possible to obtain a choice of two relatively close transmission frequencies (such as 3,105 kc and 3,120 kc) providing communication with airport and Bureau of Air Commerce radio stations. A single switch on the remote control instrument panel on the ship's instrument board simplifies the changeover to either of the two selected frequencies within the 2,000 kc to 6,500 kc. range. The radio frequency carrier is maintained exactly on desired frequencies at all times by means of low temperature coefficient, frequency control crystals which require no troublesome heaters or thermostats.

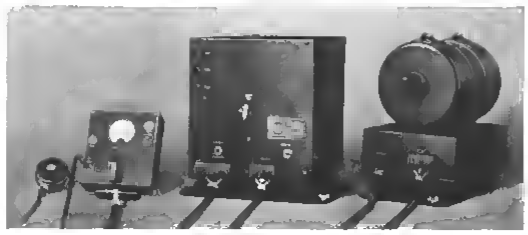
Both voice and code communication are possible. For telephone operation 100 per cent modulation of the 10-watt carrier is provided and a press-to-talk microphone is part of the equipment. For telegraphic communication 10 watts of cw carrier is available.

Power supply unit is of the vibrator type in the Model ABT-7. An alternate model the ABT-7A is supplied with a dynamotor power unit but is otherwise identical to the ABT-7.

A particular effort has been made to provide simple installation and easy maintenance. Equipment comes complete ready for mounting and can be installed by any qualified mechanic with the instructions provided. The use of RCA tubes of the low-priced receiver type and the ease of replacement of vibrator power supply units are factors that contribute to low maintenance expense. Power consumption is lower than that of the average landing light and the load on the battery is highly intermittent. When used as a



Component parts of the ABT-7 and ABT-7A transmitters.



The ABT-12 and ABT-12A transmitters

telephone the full current of 10 amp. is on only during voice transmission. As a telegraph transmitter the full current is on only when the key is closed.

Total weight of the ABT 7 complete is 28½ lb. The ABT-7A weighs 26½ lb complete. Overall dimensions of the transmitter are 10¾ in. long, 8⅞ in. wide and 7⅛ in. high, the power supply unit overall is 10¾ in. long, 8⅞ in. wide and 7⅛ in. high and the control panel is 3½ in. square.

For the pilot who wishes three frequencies instead of two in addition to the other features of the ABT-7 and ABT 7A models, RCA offers the ABT-12 and ABT-12A types. Essential differences in these two models are in the power supply units which are of the dynamotor type. The Model ABT-12 is supplied with a 50-watt dynamotor unit, while the ABT-12A has a 30-watt dynamotor. As in the smaller models, low temperature coefficient frequency control crystals are used. A single three-way switch controls any of the selected frequencies, two of which may be anywhere in the range of 2,000 to 6,500 kc. and the third must be relatively close to one or the other of the two preselected frequencies.

Total weight of the ABT-12 is 76 lb. and the ABT-12A is 64 lb. Overall transmitter dimensions are 10¾ in. long, 11½ in. wide, 11½ in. high. Overall dimensions of the dynamotor are 13½ in. long, 7½ in. wide, 12 in. high. The control box is 5¾x5¾x2¾ in.

Five-Place Stinson

Reliant fuselage widened without loss of performance

THREE'S a crowd even in an airplane, yet three is the sociability limit of a four-place ship when a pilot is employed. But what of the private owner who wants to transport a foursome? Stinson has solved the problem by widening the fuselage of the SR-8 series Reliant to provide a rear seat 52 in. wide, the same width as that of a large motor car seat. Front seats also benefit by the change and the aisle has been increased in width. And none of the ship's speed has been lost in this modification.

The five-passenger Reliants are available with Lycoming 245 or 260 hp. or the Wright 285 or 320 hp. engines and are equipped with controllable pitch propellers. Gross weights are: 3,650 lb., (245 hp. Lycoming); 3,700 lb., (260 hp. Lycoming); and 3,800 lb. (Wrights). Cruising speeds range from 140-157 m.p.h.

A new version of the Reliant for freight carrying and ambulance service, or the variety of purposes to which a plane can be applied in undeveloped country, has been introduced by Stinson. Several of these "Multi-purpose" Reliants are now in service in out-of-the-way places. They come equipped with floats, wheels or skis.

Super-Scarab

New Warner Series 50 shows several improvements

REDUCED frontal area, a more generously proportioned crankshaft, and provision of a carburetor air-intake valve to control preheated air temperatures, are the major improvements in the new Warner Series 50 Super-Scarab engine. Other new features are optional Bosch battery distributor ignition and a fuel pump drive.

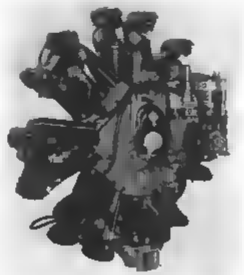
The aluminum alloy crankcase in the Series 50 Super-Scarab, is of the two-piece type and each half carries the machine steel cases for the main shaft ball bearings. The exterior of the rear main bearing case also serves as the bearing sleeve for the rotating cam ring. The new crankshaft is made in one piece and is of the single throw design.

Like the crankshaft, the connecting rods are made from alloy steel drop forgings. The master rod is of the split type four-bolt design, with a replaceable high lead bronze steel backed bearing shell at the big end.

The master connecting rod has been redesigned for greater strength and longer life. Wrist pins locked to the lower ends of the link rods are bushed into the master rod and the bronze bushings are drilled to provide full forced feed lubrication and pressed into the master rod. The upper end of the link rod also uses bronze bushings to carry the piston pins which are of the floating type.

Eight studs assemble each cylinder to the crankcase. The cylinder barrels are of alloy steel forgings and heads are made from a heat-treated aluminum alloy casting permanently shrunk and bolted to the barrels. Bronze valve guides and valve seats are shrunk into the heads.

The outer surface of the rear main bearing case provides a permanent and definite axis of rotation for the cam ring which is an alloy steel drop forging and revolves at ¼ crankshaft speed. Intake and exhaust cam surfaces are side by side with four lobes each. Driving gear is integral with the cam ring and a simple spur gear train constitutes the linkage to the auxiliary drive shaft.



Warner Super Scarab, Series 50

Cam followers take their bearing in aluminum guides, chill cast in a permanent mold. They are supported in reamed bosses throughout the entire length to prevent side motion. Contact between cam followers and cams is by means of rollers. The duralumin push rods are fully enclosed in aluminum tubes.

Bolted to the rear of the induction housing is the gear case which carries two magneto drives, and either the magnetos or the two battery distributors. A starter can be mounted between them. Oil pumps, oil strainer, and oil pressure release valves are also carried by the gear case.

The reduction in frontal area is accomplished by an induction housing of new design which brings the carburetor and carburetor air intake valve within the overall diameter of the engine. The new induction housing is a carefully proportioned annular passage in the aluminum casting which serves to support the engine in the plane. Attached to the lower side of this passage or ring is the carburetor and separate intake pipes lead directly to each cylinder.

General specifications of the Warner Series 50 Super-Scarab are as follows: number of cylinders, seven; cycles, four; bore, 4⅝ in.; stroke, 4½ in.; displacement, 499 cu.in.; standard compression ratio, 5.3 1; rated speed 2,050 r.p.m.; rated power 145 hp.; height or overall diameter, 36⅞ in.; mean effective pressure, 115 lb./sq./in.; weight, dry without hub or starter, 305 lb.; fuel consumption at rated power, 0.55 lb. per hp.-hr.; oil consumption at rated power, 0.025 lb. per hp.-hr.

The new $10,000 Reliant for five passengers.

First of the new Fairchild 45's has been placed in the service of the Superior Oil Company.

Looking forward in the sedan like interior of the new Fairchild 45.

New Fairchild 45

Minor modifications made to increase performance

EARLY this month the Fairchild Aviation Co. will make a nationwide demonstration flight with the latest low wing 45 monoplane, and it is expected that the entire scheduled production will be assigned to dealers by midsummer. The airplane used will be the second production model and is powered with a 320 hp. Wright Whirlwind R-760-E 2 engine. The first of these ships was delivered in April to the Superior Oil Co. of Houston, Tex.

The first 45 was powered with the 225 hp. Jacobs engine but the demand for a larger power plant led to the substitution of the 320 hp. Whirlwind. Also to increase performance the filleting between wing and fuselage has been modified in the light of recent discoveries in the interference drag of wing-fuselage combinations. Finally the inclination of the windshield has been altered slightly to improve both airflow and appearance.

Specifications of the current model are: length, 30 ft. 4 in.; span, 39 ft. 6 in.; height, 8 ft.; weight empty (with standard equipment) 2,474 lb., gross weight, 4,000 lb.; wing loading, 16.1 lb. per sq.ft., power loading 12.5 lb. per hp.

Performance, with full load and controllable pitch propeller,—high speed (sea level) 180 m.p.h.; cruising speed, (5,250 ft.,—220 hp.), 173 m.p.h.; rate of climb, 1,100 ft. per minute; stalling speed (flaps up), 59 m.p.h., (flaps down), 54 m.p.h.; service ceiling 18,000 ft.; absolute ceiling, 20,000 ft.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 16: Do you give free instruction to plane purchasers? If so, do you give them any further instruction beyond solo? Do you charge for demonstration time given in selling airplanes? In the sale of planes for executive or business service do you give the prospect an opportunity to use the ship on trial?

Show prospects savings

IT is our policy to give free instruction to anyone who purchases an airplane from us either new or used. This instruction includes all dual and check instruction until they obtain whatever license they desire.

We do not charge demonstration time to airplane prospects. In dealing with executives or managers of business concerns, we find it necessary to demonstrate to them by taking them on trips in order to show them exactly how much time they can save and just what is involved in the use of an airplane.—A. ELLIOTT MERRILL, *President Washington Aircraft & Transport Corp., Seattle, Wash.*

Service after purchase

WE do not charge for demonstration time given in selling airplanes and we give free instruction to plane purchasers up to and after solo. In selling business planes we do not give free trials but we try to get the prospect to use our air cab service at special rates. In that way he gets practical demonstration with no burden on us. We believe in giving good service after purchase but not much free demonstration.—H. C. ROBBINS, *President, The H. C. Robbins Co., Cleveland, Ohio.*

Prospect buys gas and oil

WE give free instruction to anyone purchasing a new plane from us, which means free instruction up to the point of solo. If they need any further instruction on navigation and cross-country trips, they pay for it at the rate of $3 an hour. Demonstration time in selling airplanes is of course given free. In approaching the head of a business corporation we often agree to take him, or the heads of departments in his company on a trial trip at practically the cost of gas, oil and pilot's time. We do not make a practice of this, but have done so on several occasions and we believe it is good business to do so, to let the prospect know how much it costs to travel from place to place in his own plane. This we find works out very well, particularly if the prospect has two or three people go with him, and we use our Stinson for this demonstration.—E. W. WIGGINS, *President, E. W. Wiggins Airways, Inc., Providence, R. I.*

★

QUESTION 16: What is your method of calculating fares for taxi service? Do you base the charge on a straight mileage basis or on other factors? Do you charge an extra premium for night flying or flying under unusual conditions? Have you found your charges agreeable to customers?

Rate depends on distance

ON taxi work around Penobscot Bay we charge flat prices for the round trip of the plane, which is lower than the trips where weather must be obtained, telegrams of departures and arrivals must be used. This is true until the trip gets up to a 200 mile range, when the scale runs on a flat mileage basis, reducing the price about 10 per cent for each additional 100 miles. We charge more over the land where forced landing would mean hardships in getting repair or perhaps structural damage. At night we charge double, but take emergency cases only. Landing in unlighted harbors with boats and driftwood adds considerably to the risk and must be compensated for. The general run of our passengers never question our price, as they know the conditions that we have to confront.—STANLEY C. BOYNTON, *Manager, Stanley C. Boynton Company, Rockland, Me.*

Use Zone System

IN the office of the St. Louis Flying Service a large map is marked off in circles with St. Louis as a center, the first circle being 50 miles from St. Louis, the second 100 miles, the third 150 miles. The prices are quoted as to zones in which the destination lies instead of an exact mileage. Any trip in zone (1), or within 50 miles of St. Louis, is $14. Any trip within zone (2) is twice that amount; any trip within zone (3) is three times that amount.

We give one free night layover for any trip further than 500 miles; two free nights layover for any trip further than 1,000 miles; and charge $10 additional for each extra night layover. We operate at night, only to lighted airports, but do this for the same as the day rates.—D. W. KRATZ, *Operations Manager, St. Louis Flying Service, Inc., St. Louis, Mo.*

Use hourly rate

OUR method of estimating fares for air taxi work is on an hourly basis although mileage is taken into consideration in the computations. An extra charge is made for night flying or operations under unusual conditions. No dissatisfaction with our rates has been noted among our customers.—F. M. JOHNSON, *President, Johnson Air Service, Alameda, Calif.*

One-fifth more at night

OUR fares on taxi work are based on mileage and round-trip road mileage is used. An extra premium of 20 per cent is charged for night flights as it is necessary to go in fields that are not lighted. Our prices have proven very agreeable to our customers.—J. L. MEADOWS, *President, Portland Air Service, Inc., Portland, Ore.*

Straight mileage charge

WE estimate all air charter fares on a mileage basis and advertise our rates plainly in a table used for direct mail distribution. We do not charge a premium for night flying. Our charges appear to be agreeable to our customers.—H. C. ROBBINS, *President, The H. C. Robbins Company, Cleveland, Ohio.*

Charges agreeable

ON taxi work I charge 10 cents per air mile for one passenger, and 5 cents for each additional passenger, and 50 per cent additional for night flying. Charges are generally agreeable, but I believe much more taxi work would be available if the costs could be reduced.—PAUL G. ODNEAL, *President, Copperclad Airways, Phoenix, Ariz.*

Question 17

(Answers will be published in July)

WHAT is your opinion of the Department of Commerce approved school regulations? Do you consider it worth while for an operator to go to the effort and expense involved in operating an approved school? If your school is approved does your experience indicate that it has helped your business? In what ways has it been specifically helpful? Have you any suggestions for modification of regulations? If your school is not approved, what reasons have led you to avoid the approved status? Would any change in the regulations make approval worth while to you?

The Maintenance Notebook

Hangar Notes

A miscellany of gadgets to aid Douglas servicing

TWA's base at Kansas City is full of clever devices to cut costs on airplane servicing and overhaul. A number of them have already been illustrated in these pages, others will follow. The group of photographs herewith illustrate a number of them seen recently about the floor of the big servicing hangar.

Readers of this department will recall the tall portable servicing stands developed by Pan American Airways for reaching engines and wings of the Clippers. Similar in purpose, but varying somewhat in detail, is the stand TWA has developed for getting at instruments and lighting equipment in the noses of Douglas airliners. Notable are the two positioning pads, one of which may be seen clearly in the picture just covering up the final letters of the word 'Columbus." Mounted on brackets connected to the hand rails, they are so placed that they bear against the sides of the nose of the ship, holding the working platform in correct position and, at the same time, steadying it. The four crank-operated screws at the corners of the base take the loads off the castering wheels, prevent the stand from moving when it is in use.

Central Air Lines eyepiece synchronizer

The two other pictures have to do with landing gear maintenance. One shows a form of wheel chock made up of welded steel angles. These chocks are light, easily carried about, but are large enough and strong enough to prevent movement of the Douglas planes. The tail dolly is made as a steel tube girder for lightness. The small rubber-tired wheels, off the ground when the dolly is attached to the airplane tailwheel, make for portability.

Engine Synchronizer

Visual Synchronization secured for Central Air Lines' Stinsons

LUTHER HARRIS, superintendent of maintenance for Central Air Lines, has developed an engine synchronizing instrument now in use on that company's Model A Stinsons. It is arranged for board mounting and is in a standard aircraft instrument case. The case contains a small rotating disk driven by a flexible shaft from the center engine. On the face of the disk, equally spaced, are nine black spots. Facing the disk, inside the case, but separated by a lightproof vertical partition, are two small neon tubes. The tubes are separately excited from the ignition system of the two outboard engines. The instrument, therefore, is a stroboscope. By adjusting the throttles of the two outboard engines until the black dots on the rotating disk appear to stand stationary, all three engines are brought into exact synchronism. The center engine is the master against which the two outboard engines are matched.

Three items seen recently in TWA'S Kansas City servicing hangar: A movable platform for servicing instruments in the nose of a Douglas, wheel chock and tail dolly.

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Shielded Bearings

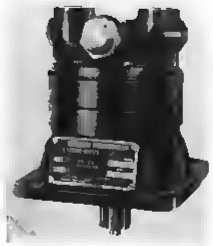
Fafnir develops new self-aligning bearings for aircraft industry

A NEW GROUP of ball bearings which combine internal self-alignment with double-grease shield protection, has been announced by Fafnir Bearing Co of New Britain, Conn They are of the double row type, the two rows of balls operating on a spherical race surface in the outer ring to provide self-alignment for shaft angularity up to 10 deg These units are pre-packed with lubricant Rings and balls are of S A E 52100 steel, and the rings are cadmium plated on exposed surfaces for corrosion resistance Two models (DKF-3 and DKF-4) are now available DKF-3 has a static radial capacity of 900 lb and a static stressed capacity of 190 lb The same figures for the DKF-4 are 1,100 lb and 240 lb. effectively

Hydraulic Pumps

Eclipse builds engine and motor-driven units for aircraft

WITH the increasing use of hydraulic power on board aircraft for operating retracting gear, wing flaps and retracting wing tip floats a demand has arisen for light-weight, high pressure pumps Eclipse Aviation Corp of East Orange, N J, has recently put on the market two forms of hydraulic pump for such service Both types are built around the "Gerotor" principle, with positive displacement internal rotary movement adaptable to high operating pressures



Engine-driven hydraulic pump

The engine-driven pump is arranged for a standard S A E generator mounting It is driven through a standard splined shaft at 1½ times engine crankshaft speed The motor-driven pump is an independent unit in which the power is supplied by a 12-volt electric motor It is supplied on its own mounting base. The electrical connections can be furnished for shielded conductors

Integral relief valves in both pump units permit varying operating pressures and volumes With the equipment normally furnished, the ratings are as follows: engine-driven type—400 lb per sq in normal operating pressure, volume, 5 48 gal at 300 r p m ; weight, 4½ lb For the motor-driven pump: 800 lb per sq in normal operating pressure, 1.8 gal at 3,550 r p.m , weight 16 lb

Eclipse motor driven hydraulic pump

Pilot's Watch

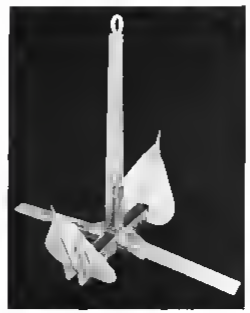
Pierce Chronograph has useful features for pilots and engineers

A COMBINATION wrist-watch, stop-watch, telemeter and tachometer is being offered by the Pierce Watch Co., Inc , 60 East 42d Street, New York. As a stop-watch it will measure time in seconds and fifths of a second, as a telemeter, it will indicate distance away from the observer of light or sound, as a tachometer, it may be used to calculate speed of moving objects

Folding Anchor

Northill Anchors used on Pan American Clippers

A LIGHT-WEIGHT folding anchor of novel design is being offered by the Northill Company, Inc , of Los Angeles, Cal These anchors are particularly adaptable to flying boats as they are compact, easily stowed and light in weight. They are made of chrome molybdenum steel and are also available in stainless steel. Navy tests indicate that a 30-lb Northill anchor has a holding power of 1,800 lb and is equivalent to a 720-lb. anchor of the Navy stockless pattern



The Northill folding anchor

Spray Gun

New Milburn Type MM gun has aeronautic applications

AN ACCOMPANYING illustration shows the new Type MM paint spray gun developed by Alexander Milburn Co , 1436 West Baltimore Street, Baltimore, Md This gun is designed especially where a wide atomized spray is required. Die cast aluminum alloy is used for the body with sprayhead of forged bronze. The nozzle is of steel with internal and external tapered seats, hardened and burnished. Atomizer head is in one piece Hose connections are standard The entire unit is easily demountable for cleaning Knurled adjusting nuts are provided to control the fluid and air-flow

The Type MM Milburn paint spray gun.

News of the Month

Zeppelin to Lakehurst

Hindenburg completes two of this summer's scheduled ten crossings of the North Atlantic

"It was a pretty fast trip We made remarkable speed for the East-West passage." So reported the Zeppelin Hindenburg's commander emeritus, the grizzled Dr Hugo Eckener, as he and his youthful-appearing veteran protégé, Captain Ernst Lehmann, were pushed into the press room at Lakehurst after the airship's first North Atlantic crossing He admitted that such speed as a regular schedule would be impossible, because of prevailing headwinds Usual route, he said, would be far south of the regular steamship lanes

Captain Lehmann, who was in active command, urged the public not to accept the first flight records as conclusive "We will make ten flights in all," he said, "and then from the average time of all ten try to draw up a schedule that we can adhere to"

Events of the next week proved the wisdom of his advice Although the Hindenburg sped her 48 passengers back to Germany in two days and 28 minutes, her second trip to Lakehurst, completed May 20 had to contend with strong headwinds, and a zigzag course added 784 miles to the normal great circle course. She took 78 hours, 26 minutes for the trip, though time for the second return trip was only 47 hours five minutes

The United States Naval observer on the first trip, Commander Scott Peck, oozed lighter-than-air good will "The engine trouble (referring to the failure of two engines on the Hindenburg's shake-down cruise to Rio de Janeiro a few weeks ago) has been completely eliminated While this trip is about one-third shorter than to South America, it is more important, because the North Atlantic has been crossed so few times It will again call attention to the great possibilities of this type of craft for military and commercial service."

As to the relative safety of helium vs hydrogen, he feels that the Hindenburg's system (using hydrogen) with gas cells well protected from passenger and crew accommodations and using non-inflammable crude oil and electricity for motive power and auxiliary drives, "minimizes the danger of hydrogen so that the risk is no greater than it is in any aircraft" As far as mooring equipment goes 'Ours is far superior to the German"

At 9 27 in the evening of May 6 the Hindenburg, 129th dirigible in the line founded by Count Ferdinand von Zeppelin more than 30 years ago, rose swiftly from her mooring at Friedrichshafen, Germany, and pointed her nose toward America. Nine and a half hours later she had dropped Lands End, England, astern and was over the open Atlantic With clear skies and following winds she fairly raced over the sea, to land at Lakehurst, N J, in the dawn of May 9 with two records, first scheduled air crossing of the North Atlantic, and a record time of 61 hours 35 minutes

Her American base for the summer's operations is the Naval Air Station at Lakehurst, where the Deutsche Zeppelin-Reederei, which operates both the Hindenburg and the Graf Zeppelin, has rented facilities, estimated to cost $5 000 per trip During the first visit, the old German-built Los Angeles gave up her place in the great hangar in favor of her newer and more magnificent sister, although the latter will remain at the mast in the open on future trips When the Hindenburg loomed in sight over the pines at the Northern edge of the station, the "L.A" was swinging idly at her mast, far out on the field

After one circuit over the trees to the south, the new giant dropped low and prepared to land For handling her on the ground the Navy expected to have 260 men on hand But Commander Lehmann was twenty minutes early, and a detachment of soldiers from Camp Dix, called in to aid, had not arrived Only 90 bluejackets stood ready to grasp her lines and walk her to the mast. Despite flag signals warning her not to land, the ship sank till her tail wheel and nose wheel touched ground. Her bow-line went out, sailors grasped her great cables and began to pull Meanwhile frantic orders "Send those soldiers down on the double!" But no soldiers appeared. By this time the bow-line had been drawn tight to the top of the mast The ship began to swing in a circle with a slight change in wind direction The press was called into action Dozens of reporters and camera men swarmed out to lend a hand with the mooring lines Slowly the ship stopped swinging The taut bow-line was drawing her great nose closer and closer to the top of the mast

The mobile mast at Lakehurst, which runs on its own tracks, is fitted with a special cone and socket coupling The main cable was drawn through this socket with a winch operated by a diesel motor in the mast's base Finally the cone slipped into place, and the nose of the 811 ft bulk was held fast. Then began the slow process of walking her up to the hangar

The ship was first towed into the great circle in front of the hangar, then a great steel flat-car, equipped with a double set of trucks, was moved around under her tail on its own circular track The tail was lashed down firmly and the "beam" continued its circuit until the tail of the ship was headed into the hangar

Before the main mast started pushing the ship in, "spacers"—long pipes supported at frequent intervals on small wheels—were attached to the mast frame and the beam, to keep the pressure at the airship's nose from making an accordion of the structure Then she was backed into her berth So large is she that when the doors were closed after her, there were but a few inches to spare at either end

Not until the Hindenburg was safely docked were her 51 passengers and crew of 56 allowed to disembark to go through the customs examinations and be interviewed by the press

American cooperation with this first scheduled Atlantic operation comes from four directions

From the Navy, which through Commander Charles E Rosendahl, who is in command of the Lakehurst Naval Air Station, turned over its well-developed facilities and trained personnel at Lakehurst It was emphasized, however, that it was at no expense to the Navy The Zeppelin's operators paid for all the costs

From Standard Oil of New Jersey, which will supply her fuel and hydrogen requirements. On the first visit 14,700 gal of fuel oil and 1,500,000 cu ft of hydrogen the latter shipped to Lakehurst in special tank cars loaned by the Navy, were put aboard

From the Tidewater Oil Company, which will supply lubricating oil for her four great 1,100 hp diesel engines.

And last but not least from American Airlines, which operates a shuttle service between Newark Airport and Lakehurst for the convenience of the ocean air travelers During the Hindenburg's initial trip, five of AA's Douglas transports made 41 round trips, carried nearly 600 passengers Of the 50 passengers who made the first ocean crossing, 37 went on to Newark via American while 42 of the 48 flying back to Germany flew to Lakehurst Sunday afternoon, an American plane took Dr Eckener, Skipper Lehmann, and other officers to New York, where they were fêted at a dinner given by the Board of Trade for German American Commerce.

Next day they went to Washington to greet the President, who had earlier sent a verbal message of congratulations to Dr Eckener at Lakehurst This message was delivered by Assistant Secretary of State R Walton Moore, who is also chairman of the President's Interdepartmental Committee on Civil International Aviation, which has recently discussed Atlantic operations with British, French, and German delegations and Pan American Airways

The Hindenburg's future home base will be not the traditional Friedrichshafen, but Frankfort, where she will be housed in the largest dirigible hangar in the world The base covers about 740 acres, and has provisions for both lighter and heavier than air.

Aviation

LAKEHURST PLAYS HOST

to the world's largest dirigible: (left) the delicate task of coupling the Hindenburg to the mobile mast Here the cone on the main cable is ready in the socket In the center Captain Lehmann looks out of the control gondola Note the shock absorbing ground wheel A similar one is used on the fin On the right, the twin port engine gondolas, each housing a 1,125 hp Mercedes Benz Diesel.

★ ***World Transport*** **. . . The Hindenburg completes first two trips.**

★ ***Domestic Transport*** **. . . Air express up 68 per cent . . . Chicago-to-Boston route for American . . . All Electra service for Chicago & Southern . . . Eastern files complaint with I.C.C. . . . TWA inaugurates non-stop New York Chicago service . . . Central drops complaint against Pennsylvania.**

★ ***Navy*** **. . . Contract for 40 scout-observations to Curtiss . . . Captain Cook to be Chief of Bureau of Aeronautics.**

★ ***Records, Races*** **. . . National Air Races for Los Angeles . . . Altitude, distance records . . . Hughes cots Chicago-Los Angeles time to ten hours.**

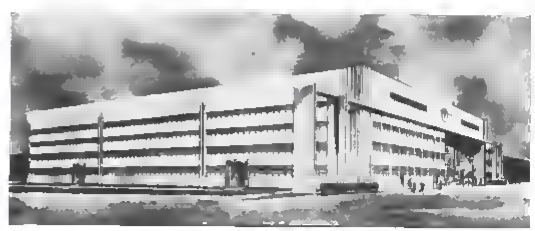
★ ***Development*** **. . . Taylorcraft being test flown . . . ATC to Arrow . . . UAL develops blind landing system.**

★ ***Industrial*** **. . . Taylor Aircraft . . . Martin sells bombers to Holland . . . Flying boat contract to Consolidated.**

Expansion, Orders

Factory enlargements at Hamilton Standard, Boeing, Douglas

Airplane deliveries and orders on hand amounting to more than $1,250,000 for the current fiscal year, were reported by B D DeWeese, president of Stinson Aircraft Corporation The 700th Stinson 4-passenger cabin plane has been delivered to the Pure Oil Company of Chicago Stinson's "multi-purpose" Reliant, according to DeWeese, has been well received in the export market. The plane normally fitted to

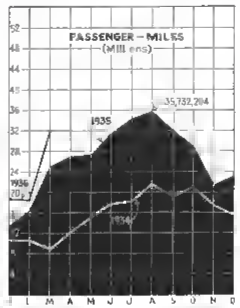


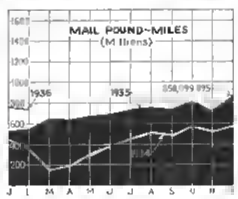
ROOM FOR PRODUCTION

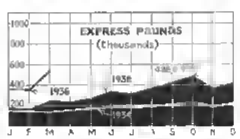
of Boeing 333s will be provided by this new hall at Boeing Field Seattle, under construction on a recently acquired 22-acre tract

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







catty passengers, is readily convertible for photographic or ambulance missions.

Orders for the prolific Cub have been pouring into the offices of the Taylor Aircraft Company (Bradford, Pa.) so fast that deliveries are running several weeks behind. The company is planning installation of new equipment to speed up production. April production was up 76.2 per cent over April 1935. Thirty-seven Cubs were produced during that month.

Reports from Sidney, N. Y., indicate that Scintilla Magneto, Bendix Aviation subsidiary, is planning plant expansion.

Airplane Development Corporation's chief engineer, Gerald F. Vultee, has confirmed recent reports that the plant will be moved from Grand Central Air Terminal, Glendale, Cal., to larger quarters at Downey.

Hamilton Standard Propeller Division of United Aircraft Mfg. Corp. is to have a new 100,000 sq. ft. plant at East Hartford, Conn. At present Hamilton Standard shares the same building with Pratt & Whitney.

The sixth and final bay of a new hangar for Douglas Aircraft at Santa Monica, Cal., was completed early in May. Enclosing 85,500 sq. ft. of floor space, the building will have a clear span of 250 ft. It is said to be the largest single arch structure built in the twentieth century. Two other new units at the Douglas plant, with a combined area of 285,000 sq. ft. will with the new building, more than double the size of the present factory. The engineering department of the company now works in an enormous soundproofed room which covers the entire upper floor of one of the new units.

A building large enough to house nine fully assembled Boeing 299 bombers was begun in May at Boeing Field, Seattle. It will be 204 ft. wide, 304 ft. long, and 53 ft. high. Clearance through the doorway will be 200x35 ft. Walls will be of insulated metal sheathing. ft. will be used as a final assembly plant.

Rumors recently current in the industry that Glenn Martin was negotiating for a bomber order from the Netherlands were confirmed May 12 when the Netherlands Colonial Office announced that it had ordered thirteen of them. Presumably they are intended for Dutch East Indies service.

An $870,000 contract for flying boats of the U. S. Navy XP3Y type has been awarded to the Consolidated Aircraft Corporation, San Diego, Cal. Purchaser is an unnamed South American republic.

It was recently announced that the Bendix Aviation Corporation has purchased a substantial interest in the Jaeger Watch Company, N. Y.

Crusader Aircraft Corporation of Denver has received a $125,000 contract from Mountain Airways Corporation of Rawlins, Wyo. The contract calls for five of Crusader's low wing twin-engined planes. The ship seats five passengers and two crew and is powered with two six-cylinder Menascos Model C6S-4 which develop 250 hp. each at 5,000 ft.

Flight tests are now under way on the first Taylorcraft at Pittsburgh Butler Airport. This machine, described in AVIATION for May, 1936, will soon go up for its ATC tests. It is planned to put the plane into production immediately and according to reports there are enough orders on hand to warrant building up production to ten per week by late summer. Designer is C. G. Taylor, who resigned as president of Taylor Aircraft, Bradford, Pa., last January. He is now associated with Bart Peat and Byron H. Shinn (Shinn Devices, Inc.) in developing an aircraft and accessory center at Pittsburgh Butler Airport.

The Arrow Model F Arrow Aircraft & Motors' candidate for Department of Commerce light plane honors has received its ATC. The plane was described in AVIATION for May, 1936.

The Aeronautical Corporation of America, Lunken Field, Cincinnati, has granted license to manufacture Aeroncas in Great Britain and Europe to the Aeronautical Corporation of Great Britain. The British firm reports orders for 125 of the light monoplanes.

The Navy has awarded Curtiss Aeroplane & Motor a $759,680 contract for 40 scout observation planes and parts. Engines will be Pratt & Whitney Wasps, which are not included in the contract price.

Races to Los Angeles

Annual air classic forced by field conditions to leave Cleveland

BECAUSE an extensive improvement program underway at Cleveland Municipal Airport will not be finished in time, the National Air Races, scheduled for Sept. 5, 6 and 7, will move to Los Angeles, scene of the event three years ago. With the publication of the program some weeks ago it was hinted that the move would be made. It was definitely announced by Clifford Henderson, managing director of the races, May 20.

Cook to Command

Navy Shifts Chiefs of the Bureau of Aeronautics; King assigned to aircraft Base Force

IN JUNE Capt. Arthur B. Cook now commander of the aircraft carrier Lexington, will become Chief of the Navy Bureau of Aeronautics. He will succeed Rear Admiral Ernest J. King, who will be assigned to command the aircraft Base Force with the fleet. Subject to Senate confirmation, Captain Cook will serve a four-year term, will assume his command just in time to direct the Navy's drive to strengthen its air arm.

The appropriation of about $27,000,000 provided for new planes and engines in the pending Naval Appropriation Bill is estimated as sufficient for 502 planes this year. It will be part of Captain Cook's job to bring the Navy's active force up to 1,692 planes by July 1, 1937.

The new chief received his flight training at the Naval Air Station at Pensacola in 1928, and took command of the aircraft carrier Langley upon graduation. During the War he was flag lieutenant to the Commander-in-Chief of the United States Fleet.

Among other Navy notes is announcement of a new trophy to be known as the Rear Admiral William A. Moffett Memorial Trophy to be

awarded annually to the battleship or cruiser-based aviation unit which conducts its operations throughout the year with the maximum of safety. It corresponds to the present Herbert Schiff Memorial Trophy, except that it is competed for by fleet-based units, which operate under more exacting conditions.

Automatic Landings

United develops blind landing system around Sperry's Gyropilot

BLIND landing experiments are not new to the airlines (see AVIATION, May 1933), but so far everything has depended on the pilot's translation of instrument readings into action on the controls. Four years ago United Air Lines' communications engineers started experiments at the Oakland, Cal., Municipal Airport with a device to tie up radio landing aids with automatic piloting. Last month United's president, W. A. Patterson, announced successful results for the experiment.

The system utilizes two special radio beams. These—marking center line of the runway and altitude in the downward glide—register on an instrument in the pilot's cockpit, consisting of two needles, one vertical for the runway beam and one horizontal for the landing beam. The pilot, on approaching the field, passes over the cone of silence of the regular radio range beacon until he has fixed in his mind his relation to the ground. He then intercepts the two special beams at about 1,000 ft. altitude, 5 miles from the edge of the field.

After maneuvering to get both the instrument pointers at zero, he throttles down to about 85 m.p.h. and turns control over to the automatic pilot. His only concern then is slight adjustments to the gyropilot to keep the pointers at zero. The landing is made in a level flying attitude—two points with the tail up. Due to the action of the automatic pilot, brakes may be applied full force as soon as the wheels touch ground, with no danger of nosing over. The difficulty usually encountered of maintaining a straight course when unable to see outside the plane is also eliminated.

Although United's specially equipped Boeing has made 250 successful landings at Oakland, the line is not yet ready to apply it to regular operation, and may not be for "several years," according to Patterson. UAL considers the experimental practice flights helpful in contributing to their pilots' flying technique.

UNITED AIR LINES
uses this specially designed antenna on the nose of a Boeing 247-D for blind landing experiments at Oakland Municipal Airport

On the Lines

Air express again up. Traffic marks for Central, Eastern, PAA, UAL; new schedules for TWA, American

AGENTS of the Air Express Division of Railway Express Agency in 215 airport cities have reported a gain in air express shipments of 68 per cent for March 1936 over March 1935.

C. R. Smith, president of American Airlines, has announced direct Boston-Chicago service with Buffalo the only stop. Schedules will be inaugurated in the first two weeks in June, will utilize American's new Douglas DC-3s.

On Central Airlines' second birthday May 16, president J. D. Condon said that "with almost 400,000 passenger miles each month, 1936 points to the banner year for Central." In two years the line has flown a total of 1,798,423 miles over its Washington-Pittsburgh-Akron-Cleveland-Detroit route. Passenger-miles total 4,096,003, express pound-miles 30,572,802, mail pound-miles 121,115,370. Central operates a fleet of five Stinson A's.

On May 1 Chicago & Southern Air Lines inaugurated new schedules on the Chicago-New Orleans route with four twin-engined Lockheed Electras. Schedules call for departure from Chicago at 9:15 a.m. and 5:30 p.m. and arrival at New Orleans at 4:35 p.m. and 12:15 a.m. Northbound, the Electras will leave New Orleans at 9:05 a.m. and 5 p.m. and arrive at Chicago at 3:40 p.m. and 11:59 p.m.

Eastern Air Lines, through North American Aviation, Inc., has filed a complaint with the Interstate Commerce Commission against competition from American Airlines on the Chicago-Washington and Washington-Newark routes. Eastern holds the mail contract for these routes.

Mayflower Airlines, Inc., a new summer operation between Boston and Nantucket, was started early in May. Scheduled time over the route is 1 hour and 15 minutes. The line, under the direction of Operations Manager Parker Gray, will fly four 10-passenger Stinson A's, recently purchased from American Airlines. Route is by way of Hanover, across the bay to Provincetown, thence to Hyannis, Martha's Vineyard and Nantucket. It is planned later to equip one of the planes with floats and make a stop at Plymouth. Two round trips a day will be flown.

Eastern Air Lines and Pan American Airways flew 22,665 passengers in or out of Miami in the first quarter of 1936. In the two years since the terminal opened PAA's total passenger traffic was 72,654, and its share for this year's first quarter was 14,083. Eastern's first quarter accounted for 8,582 passengers.

April 26 was the ninth anniversary of Pennsylvania Air Lines operations On that date the 103,000 mark in number of passengers carried was passed

Non-stop New York-Chicago service was inaugurated by TWA on May 1, with a four hour 45 minute westbound and three hour 58 minute eastbound schedule.

Encouraging reports from United Air Lines for the first quarter of 1936 show a gain of 17 per cent in revenue passenger miles, 61 par cent in express and 10 per cent in air mail The line completed 95 5 per cent of its scheduled 3,341,243 miles

The first complaint charging unfair competition by one airline against another was filed by Central Airlines with the Interstate Commerce Commission Nov 16, 1935 Central charged Pennsylvania Airlines with adjusting schedules on its Detroit-Washington route to lure passengers from Central April 20, on Central's own motion, the ICC dismissed the complaint

Hearings before the ICC are scheduled for June 2 on TWA's petition for off line service between Albuquerque and San Francisco The rumored purchase of Braniff by TWA moved a step nearer realization last month when Post Office Solicitor Karl A Crowley called a hearing in Washington for June 10

Records, Records

Amy Mollison, Hughes, Buck, Richey, Gipson, in a splurge of spring activities

In a little under eight days early in May, Mrs Amy Johnson Mollison broke three England-Capetown records She left Gravesend, England 9 05 a.m., May 4, and on May 7 was in Capetown South Africa, with an elapsed time of three days six hours 26 minutes. This lowered by eleven hours, nine minutes the record set for the run by Flight Lieut Tommy Rose last February On May 10 she pointed her Percival Gull back toward England, and landed at Croydon, near London, in four days, sixteen hours, sixteen minutes, beating Lieut. Rose's record by one day, fourteen hours, 41 minutes Her seven day 22 hour, 42 minute round-trip bettered Rose's by two days, one hour 52 minutes.

In America, records fell thick and fast At Fort Lauderdale, Fla Mrs Annette Gipson spiraled her little Monocoupe to an altitude of 12 628 ft., to establish an American women's multi-passenger altitude record for light planes The barograph was sent to the National Aeronautic Association for calibration. Mrs Gipson carried one passenger

Altitude record for the feminine single-seater light airplane category was shattered at Endless Caverns, Virginia May 9, by Helen Richey Flying an Aeronca, she climbed to 18,448 ft, to win a $200 prize offered by Endless Caverns Airport.

But not all record smashing was done by women May 5 Robert N Buck, of Westfield, N J left Union Air Terminal, Burbank, Cal, optimistically set his course towards Newark, N J Immediately after taking off, he dropped his landing gear Two thousand miles later he skidded his plane to a landing on its belly at Columbus, Ohio, to break the light plane distance record.

To win a $50 bet that he could have lunch in Chicago and dinner in Los Angeles, Howard Hughes took off from Chicago in his Northrop Gamma at 11 05 a m P.S.T., May 14 He roared into Grand Central Air Terminal, Glendale Cal, eight hours ten minutes and 25 seconds later

Martin Suit

36 aircraft firms made defendants in $90,000,000 action

James V Martin, who for years has been filing patent infringement suits against various aircraft manufacturing firms and individuals, last month included practically the entire industry in one fell swoop He filed suit against 30 manufacturing or holding corporations and six airlines, to say nothing of 70 individuals. He claims $30 000,000 personal damages and asks triple damages under the Sherman anti-trust law

Principal charges are that the defendants have supplied the government over a period of years, with "unsafe, inefficient, unstable and obsolete planes." He claims that the "aircraft trust" took action resulting in driving him "out of business, of ruining him financially, and of rendering useless and compelling to remain idle" his factory and machinery at Garden City New York

Retorted the Manufacturers' Aircraft Association, one of the defendants "Published reports concerning James V Martin's charges that American Aircraft manufacturers have crippled the national defense indicate the absurdity of his complaint, as it is well recognized that American aircraft lead the world in design and performance There is no such thing as an aircraft trust in this country and there never has been"

Calendar

June 6-7—Sixth Annual National Air Carnival, Birmingham (Ala) Municipal Airport.
June 6 & 13—Eighth Annual Connecticut Model Aircraft Meet, Hartford.
June 11-13—Oklahoma State Air Tour
June 12-13-14—Missouri State Air Tour, St Louis Mo
June 16-20—Second National Intercollegiate Flying Club Meet Wayne County Airport Detroit, Mich
June 23-July 6—Seventh Annual National Soaring Contest, Elmira, N Y
June 22-24—Eighth Annual Indiana Air Tour Indianapolis Ind.
July 3 4-5—National Balloon Race and Air Race Meet, Denver, Col
Aug 1—Western Canada Annual Air Show Vancouver B C
Sept 5-6-7—National Air Races Los Angeles Cal.
Oct 25—Paris Saigon Air Race
Jan. 26 Feb 6 1937—Aircraft Show, New York

Sperry Award

$10,000 fund for annual award for achievement by young men

In memory of Lawrence B Sperry, blind flying pioneer who died while crossing the English Channel in 1923, a $10 000 fund has been placed in the care of the Institute of the Aeronautical Sciences by Elmer A Sperry, Jr, Edward G Sperry, and Helen Sperry Lea, his brothers and sister An annual certificate and award of $250 will be made to the young man who has made "the greatest contribution to the advancement of aeronautics during the year" The award committee for 1936 consists of Grover Loening, Glenn L Martin, Charles L Lawrence, Maj James H Doolittle, Elmer A Sperry, Jr., and Maj Lester D Gardner

Financial

1935 profits for Pan American, Warner; first quarter profits for Douglas, United Aircraft

The Consolidated profit and loss statement of Pan American Airways Corporation for 1935 shows total income for the year of $10 127 837, and total expenses of $[illegible] 934 105 leaving a net profit of $1,193,732

Net sales amounting to $202 607 brought Warner Aircraft Corporation a net profit, after taxes, depreciation and other charges, of $15,953 for 1935 Sales were up from the 1934 figure of $188 202

Bowser & Company showed a net loss for 1935 of $28,032

United Airlines' first three months of operation in 1936 resulted in a loss of $355 870 This was up from the corresponding 1935 figure of $329 678

Profits for Douglas Aircraft for the quarter ended Feb 29 were $18 185

Boeing Airplane Company reduced its 1935 first quarter loss of $213 262 to $41,469 for the first quarter of 1936

First quarter operating profit of $256 520 is reported by United Aircraft Corporation Total net profit for the quarter is $350,952.

Canadian Airways, Ltd., showed a 1935 operating profit of $35,453, though provision for retirement expenses resulted in a $132,590 net loss for total operations

Schools, Services, and Airports

● ALABAMA—Several recent additions to the plane fleet at BIRMINGHAM Municipal Airport have recently put hangar space at a premium . . An air show featuring Dorothea Aiken and Jessie Martin was scheduled at Capital Airport, MONTGOMERY, late in April . . . Clearing and grading work has been started at CLANTON Airport on additional land purchased to enlarge the field . . Committee chairmen selected for BIRMINGHAM'S sixth annual air carnival to be held June 6-7 at Municipal Airport are: Hayden Brooks, Dave Denney, Asa Roundtree, Julian Martin, Homer Panter, Sam Clabaugh, Jake Moose, Brown Hill, Harry Frazier, Elizabeth Mayes and W O Downs. The carnival is being sponsored by the Birmingham Aero Club of the City of Birmingham

● ARKANSAS—Lou Garrett, executive chairman of the committee arranging an aviation meet to be held at PINE BLUFF, as one of the features of the Arkansas centennial celebration this summer, is considering a suitable date for the meeting. He is assisted on the committee by Fred Bellingrath, F G Smart, Russell Lambert and Lieut Kenneth Garrett. . . . FORT SMITH City Commission is considering a bond issue for purchase and development of Alexander Field, across the Arkansas River in Oklahoma. WPA has allocated $50,000 for the project if the city obtains title. The field is located about a mile from the business district of Fort Smith.

● CALIFORNIA—SAN DIEGO is considering trading title to the Marine Corps rifle range, consisting of 400 acres, for title to 60 acres of tidelands adjoining Lindbergh Field. If the exchange is approved, it will permit the lengthening of runways at the field and an opportunity for expansion of Consolidated Aircraft Corporation's plant . . Joe Plosser, of Grand Central Flying School, GLENDALE, led a squadron of six planes from his home field to RIVERSIDE Airport early in April. At Riverside, the party was taken to breakfast by Kenneth Brooks, airport manager . . Rodney E Bacon has been appointed chairman of the Aviation Committee of the SANTA ANA Chamber of Commerce . . The Pathfinder Flying Service, Ltd., of STOCKTON, has leased the MODESTO Municipal Airport, which it will manage for the city. Operation will be under the direction of Arthur Jenks, who will be assisted by Clarence Coffee, Richard Lowell and Thomas Davis. The company plans cross-country charter flights, aerial mapping and flying instruction. Two of the company's six planes will be based at Modesto and will provide a 38 minute service to SAN FRANCISCO and a two hour and 35 minute service to LOS ANGELES. It is also planned to improve the field and modernize the lighting system . . SOUTH PASADENA is considering the erection of an air marker on the roof of the new Garfield reservoir.

● DELAWARE — Joseph Manning, manager of du Pont Airport, WILMINGTON, has announced that a radio beacon will be constructed at the field about the middle of June.

● FLORIDA—R V Waters has been elected president of the MIAMI Airport Association for the tenth consecutive year. Other officers: William V Dee, first vice-president, Burton E Folsom, second vice-president, J T. Larimore, third vice-president, C D Leffler, treasurer, and A W Eisemayer, executive secretary and assistant treasurer.

● GEORGIA — Strachan Skyways, Inc., has been inaugurated at the SAVANNAH Municipal Airport late in April, a new hangar being dedicated at the same time. The company is headed by H G Strachan, who will use a new Stinson 4-place cabin ship for student instruction, aerial photography and taxi service. Student instruction will be under Foster Thomas. The hangar is equipped with a repair shop, waiting room and administration offices . . Frank Ward, VALDOSTA, recently soloed a student in a Taylor Cub after one hour and 45 minutes of instruction. The Lions Club of ALBANY has appointed a committee to investigate the possibility of securing a hangar for Albany Airport. It is reported that the WPA has approved allotment of $2 000 for the project if Albany will contribute $500. . . Ralph Swaby has leased the COLUMBUS Municipal Airport for another year . . . ATLANTA is planning a new airport on the old Camp Gordon grounds 12 miles from the city. Plans call for the erection of three hangars. Total cost of the field would be about $425,000.

● ILLINOIS—The Exchange Club of SPRINGFIELD sponsored an aviation week early in May to stimulate interest in aviation in central Illinois. The Illinois Aeronautic Commission, the National Aeronautic Association, the Junior Birdmen, and the Y M C A. cooperated. . . Frank Fleck, of SPRINGFIELD Municipal Airport, has purchased a new Taylor Cub, for which he is Springfield distributor.

● INDIANA—Appointments announced by William Ames, president of the St Joseph Valley Aviation Club, SOUTH BEND, are George Sweisberger, flying and field manager; Forest Miller, sale of flying tickets, and Edward Michalski, chairman of the publicity committee. . . . TERRE HAUTE Junior Chamber of Commerce was planning an air show at Paul Cox Field early in May. Marshall Kerr has been appointed general chairman. The show will include stunt flying, racing, skywriting, formation acrobatics and parachute jumps . . BLUFFTON is considering establishment of an airport and is seeking WPA assistance for the project . . The Eighth Annual Indiana Air Tour, to be held June 22-28, will be under the direction of Herbert O Fisher, aeronautics director for the INDIANAPOLIS Chamber of Commerce. Records show that 502 planes carried 1,200 passengers in and out of Bendix Municipal Airport, SOUTH BEND, in 1935.

● IOWA—The ESTHERVILLE Chamber of Commerce has decided to use the old airport site east of the highway maintenance building pending acquisition of a better site . . . IOWA CITY is seeking WPA assistance for a 625 ft extension to one runway. A farmer whose land adjoins the field has erected a 24 ft. pole near the end of the present runway, claiming that United Air Lines planes have been flying too low over his stock. Until the pole is removed or the runway extended, the line refuses to land there.

● KANSAS—Arthur and Rolley Inman offered plane rides at WICHITA late in April, using a tri-motored Ford and a 6-place Stinson. Also scheduled on the program was a parachute jump by Carl Hall.

● KENTUCKY—The Louisville and Jefferson County Airboard has leased Bowman Field, LOUISVILLE, for $1 a year for a period of 25 years. There have been suggestions by real estate men that the location of the field be changed because land adjacent to it was losing value. A ten-year lease due to expire in 1938 was cancelled by the Board of Park Commissioners in favor of the new 25-year lease.

● LOUISIANA—The Five Air Aces under the direction of Hugh Mitchell, were scheduled to put on an air show at BATON ROUGE early in May. Other pilots are: L C Shannon, Glenn Hoffman, Barney Root and Irvin Davis.

● MAINE—The President has given his approval to a WPA project for runway construction at BANGOR Airport. City Council has voted to spend up to $30,000 for the work. Two 500-ft wide runways, 3,000 and 2,200 ft. in length, will be built. Installation of two way radio equipment at the field has recently been completed by Boston-Maine Airways. . . . Work on the AUGUSTA State Airport, which has been under way for two years, is nearly complete. Most of the night lighting equipment has arrived and is being installed. The Bureau of Air Commerce will install a radio range beacon, to be located on Granite Hill. WPA workmen are still grading the runways and approaches.

● MARYLAND—Bids for construction of a new hangar at HAGERSTOWN Airport ranged from $20,000 to $37,000. The Mayor and City Council had estimated that maximum cost would be $15,000.

● MASSACHUSETTS — Mayflower Airlines, Inc., has just begun service from BOSTON Municipal Airport to CAPE COD, MARTHA'S VINEYARD, and NANTUCKET. The line, under Operations Manager Parker Gray, is using four 10-place Stinson planes. It is planned later to equip one of them with floats and make a stop at PLYMOUTH . . . TURNERS FALLS is considering enlargement and improvement of Franklin Airport. One plan is to make a circular field with a 3,500 ft radius. There is $54,000 available from WPA for improvement work. To obtain this the city would have to spend $8,000. In an intercollegiate air meet at the FRAMINGHAM AIRPORT late in April the Harvard Flying Club defeated the Amherst Flying Club 25 to 8, winning the 500-ft. spot landing, the bomb dropping, and the 360 deg. spot-landing events. Field operations were in charge of Gordon Cameron, airport manager . . William E. Martin and T Jefferson Newbold, Jr., have formed a company at BOSTON under the name of Martin and Newbold, Inc. They will operate a charter service and sell air travel tickets . . An additional $45,000 has been allotted by the WPA for improvements at LAWRENCE Airport. The WESTFIELD City Council has voted an $8 000 bond issue and a $6 000 appropriation from this year's tax levy to secure an $85 000 grant from the WPA for improvement and development of Barnes Airport. The $14,000 thus provided represents a half interest in the field. A similar proposal is before the HOLYOKE City Council.

● MICHIGAN—Appointed to an executive committee on arrangements for an air travel exhibit at Bishop Airport, FLINT, on June 14, are Louis D McGregor, S S Stewart, Wayne M Stettbacher and Ralph Helgeby. The exhibit will be sponsored by the Flint Chapter of the National Aeronautic Association. WPA has given final approval to an airport improvement project at WHITE CLOUD. Plans call for grading of the intersection of the runways, construction of a concrete circle 100 ft in diameter, the lowering of telephone lines and installation of cone type markers along the edges of the runway. Plans for the improvements were drawn up by the State Board of Aeronautics. WPA has allotted $19 000 for construction of a 60x40 ft. hangar at the DICKINSON COUNTY Airport. The hangar will be made of concrete block . . State WPA has approved allotment of $8,692 for construction of an intermediate airport in NORWAY.

● MISSOURI—Three airlines using KANSAS CITY Municipal Airport have recommended extensive changes in the field to provide facilities for the large planes now under construction. The improvements would call for an expenditure of close to $1,000,000, and would include moving of the Missouri River levee and strengthening it so that the airport buildings and the airport would not be endangered by flood. This would add 160 acres to the operating boundaries. Other necessary improvements would be lengthening the runways and paving them with reinforced concrete, widening them to a width of 300 ft., installation of taxi strips from the end of the runways to the terminal buildings, larger loading ramps, flush type runway lights on all runways, a new beacon light and a lighted wind indicator. Also called for is a traffic control tower, centrally located, and a new terminal building, replacing the present one, which is held to be inadequate. . . The old hangar at Rosecrans Airport, ST JOSEPH, has been emptied of all equipment. The hangar will be moved to a new field about 3 miles west of the present one.

● MONTANA—Earl Harris has been appointed manager of HELENA Airport. It is expected that the two airlines operating into Helena will occupy their offices in the new terminal building by June 1.

● NEBRASKA—WPA has approved three additional airport projects in Nebraska: GRAND ISLAND, $68,710 for constructing runways and an administration building; NORTH PLATTE, $1,491 for general improvements; OMAHA $262,550 for repairs and additions . . Additions and improvements at the LINCOLN Municipal Airport costing an estimated $270,000 have been asked by the city in an application to WPA. The city's share of the expense will be salvaged asphalt worth $19,000, and engineering, supervision and inspection worth $1,000. Proposed additions include six new floodlights and a new runway, which will be 2 500 ft. long. The old runways will be extended.

● NEW JERSEY—Newark is building a $100,000 seaplane base adjoining the inshore channel of the Port of Newark. It has a shore frontage of about 400 ft and a depth of 300 ft. from the bulkhead line with 2,000 additional shore frontage available. Present plans call for the construction of one large hangar, which will be moved from Newark Airport. The new seaplane

JUMPING-OFF PLACE

for Autogiro Company of America's experimental ship last month was New York's Municipal Airport No 2, at North Beach. Pilot Jim Hay is demonstrating the jump take-off characteristics of the ship.

base will have four floats each 40x20 ft connected with the waiting room by a 175 ft. ramp. . . . The NEWARK Board of Commissioners has passed an ordinance authorizing the issuance of bonds in the amount of $500 000 for improvement work at Newark Municipal AIRPORT.

● NEW YORK—Ailor Sales Corp., Roosevelt Field, MINEOLA, has completed the installation of special radio equipment in the four tri-motored Fords purchased by the Colombian Government. . . . William F. Luke has been appointed manager of the SCHENECTADY County airport. Luke was co-founder in 1929 of Mohawk Airways, Inc. He has lived in Schenectady for twenty years. . . . SYRACUSE Municipal Airport has been leased to American Airlines for a maximum of $1 500 for this year. The term is for one year. . . . Bids for reconditioning the Department of Commerce field at NEW HACKENSACK have been opened. Plans call for the grading of 6,000 sq yd. and seeding 60 acres. . . . WPA has recommended an appropriation of $82,000 in addition to the original allocation of $330,000 for construction of a new 3,000-ft. runway at SYRACUSE Airport. . . . The SARATOGA SPRINGS City Council is considering contribution of $30 000 in materials and equipment to obtain a $120,000 allocation from the WPA for construction of an airport there. . . . Improvement work at TOWANDA airport is scheduled to start by June 1. Plans call for grading 30,000 sq yd. and constructing a macadam runway a half mile long. . . . Max Pollet, president of the New York State Aviation Association, has announced that he believes the association's fight against the Feld bill in the legislature, which would set up a state aviation commission with drastic taxing powers, has been successful. . . . George Haven has been named assistant manager of the SCHENECTADY County airport. He will be in charge of mechanical operations.

● NORTH CAROLINA—Eighty-five men are at work on the $100,000 WPA improvement program at the ASHEVILLE HENDERSONVILLE Airport. . . . Jack Cottrell, manager of CHARLOTTE Airport, announces that the old hangar has been reconditioned and the mechanic's shop has been completed. The Stinson Reliant flown by Dexter Martin of the State Aeronautical Commission, is being reconditioned at the field. . . . Grading work at GREENSBORO Municipal Airport, being done as a WPA project, was scheduled to be finished early in May. Three hundred thousand cubic feet of earth will be removed. . . . The Cannon-Nelson Aircraft Corp. has been chartered at CHARLOTTE. It is run by Joseph F. Cannon, Jr., and Hugh R. Nelson. The company will operate a repair shop at Charlotte Airport and will do charter flying and student instruction. . . . Pilots at Miller Municipal Airport, WINSTON-SALEM, report a steady increase in charter flying. . . . Plans are being formed for the dedication of the CHARLOTTE Airport late in August.

● OHIO—Chester Fenton, manager of Transcontinental Airport, TOLEDO, bought a new Lambert Monocoupe. . . . The NEW PHILADELPHIA City Council has voted to spend the $15,000, raised by a bond issue last December, for construction of a 15-plane hangar at the municipal airport. . . . Chester H. Betz and Rudolph A. Van Devere are taking over Air Services, Inc. at AKRON Municipal Airport. The new name for the company will be Akron Airways, Inc. Betz has been working for Air Services for a year and a half and Van Devere is manager of the South Bend (Ind.) Airport. B. E. Fulton is manager of Akron Airport. . . . The Board of Directors of Transcontinental Airport, TOLEDO, has approved a proposal that the city purchase the field. Stockholders have offered to sell the field for $162,000. . . . Title to the 311-acre airport at VANDALIA has been transferred to the city of DAYTON. The $65 000 purchase price was raised by public subscription. The field is now eligible for a $673,000 WPA improvement fund.

● OKLAHOMA — Runway extension work financed by WPA funds at TULSA Municipal Airport has been resumed following a delay over material, according to Charles Short, Jr., airport manager. Three weeks will be required to finish the northwest runway, which will be 100 ft. wide and 3,300 ft. long. The east-west runway also will be extended. The project, which employs 170 men, also includes a northeast-southwest runway 100 ft. wide and 3,300 ft. long. . . . Albert Lehr has been elected president of the TULSA chapter of the National Aeronautic Association. Stanley J. Ehlinger was elected vice-president and Cleo W. Clifford, secretary and treasurer.

● OREGON—Thomas A. Culbertson Jr., manager of MEDFORD Municipal Airport, has reported that 185 planes used the field in April. They were classified as follows: 130 United Air Lines, 37 U. S. Government; 14 private, and 4 commercial.

● PENNSYLVANIA — ALLEGHENY County commissioners have authorized application to the WPA for a $625 000 fund for construction of an airport at NORTH PARK. Of this amount the county would contribute $55,000. . . . Improvement work at MEADVILLE was scheduled to start late in April. Plans call for two 200-ft. runways 3,500 and 2,800 ft. long, grading and draining, and a new 60x60 ft. hangar. The work will be done as a $185 000 WPA project. SCHUYLKILL County is considering construction of a county airport at FRACKVILLE. It is understood that the WPA has allotted $78,000 for the work provided the county contributes $4,500 in equipment and materials. . . . The WPA has allotted $392 000 for improvement work at READING municipal field. Leveling work will necessitate moving 625,000 cu. yd. of earth and rock. Three runways will be built, 3,600, 3,000 and 2,400 ft. in length. Work will start

American Swedish News Exchange

RUNWAY CONSTRUCTION

In Sweden. The $1 232,000 airport at Hromma, near Stockholm, which is scheduled to open soon. It has three 3,602 ft. and one 2,232 ft. runways.

early in June. Twenty-five men were scheduled to start work early in May on the $175,000 improvement project being carried on by the WPA at WARREN airport. The MONTOURSVILLE City Council has appointed Lynn F. Probst manager of the municipal airport. The WILLIAMSPORT City Council is considering enlarging the hangar at the municipal airport. . . ERIE City Council has authorized acquisition of land which is now the site of Port Erie airport. The land will be developed with a $500,000 WPA fund. . . The WPA is considering construction of an airport near KITTANNING to cost $254,400, of which $15,000 would be contributed by the sponsors. . . . The ALLEGHENY County Advisory Air Board is urging expansion of the PITTSBURGH-ALLEGHENY County Airport. Plans call for PWA expenditure of $758,000 and a county contribution of $85,000. Plans include construction of a new hangar and extension of four runways to enlarge the field on its west side. . . The Bureau of Air Commerce has approved an expenditure of $151,000 by the WPA for improvement at ALLENTOWN BETHLEHEM Airport.

● RHODE ISLAND—The E. W. Wiggins Airways, Inc., PROVIDENCE, has purchased a new Taylor Cub. The radio traffic control station at the State Airport, HILLSGROVE, has been licensed by the Federal Communications Commission.

● SOUTH DAKOTA—Orville Hickman has been placed in charge of the shops at Sioux Skyways Airport, SIOUX FALLS.

● TENNESSEE—It has been announced that enlargement of MEMPHIS Municipal Airport will be completed in about five months. About 170,000 sq yd of concrete will go into the new runway, and the airport, when complete, will contain 300 acres.

● TEXAS—Under the leadership of Hal Henning, DALLAS Stinson distributor, more than 25 planes left Love Field, Dallas, late in April for four-day air tour of the state. It was the annual Texas State Air Tour and also served as a good-will mission for the Texas Centennial Exposition, opening in Dallas June 6.

● UTAH—SALT LAKE CITY commissioners have approved acquisition of an additional 40 acres of land on the north side of the municipal airport for $346. The land will be acquired by trading other city-owned land for it, and the money will go for construction of bridges across the Jordan River and payment of delinquent special taxes, which amount to $960.

● VERMONT — MONTPELIER City Council has authorized issuance of notes for $3,000 to pay for the city's share of needed equipment for the BARRE-MONTPELIER Airport improvement.

● VIRGINIA—The LYNCHBURG Flying Club has recently added seven new members. The club is studying air commerce regulations. . . The Mayor of GREENVILLE has appointed a committee of three to investigate steps necessary to secure WPA funds for construction of an airport there. . . State WPA has allocated $15,950 for the installation of radio equipment at Byrd Airport, RICHMOND.

● WASHINGTON—Five flying services using Felts Field, SPOKANE, have complained to the City Commission that hangar fees are too high. They ask that charges be lowered from $25 per month to $10 per month, pointing out that outside pilots using the field pay no fees at all. . . KELSO City Council is considering enlarging Kelso Airport. There is a possibility that the WPA will provide $12,000 for improvements at the field. . . . $2,320 has been released by the WPA for the beginning of runway improvement work on a $38,000 WPA project at WALLA WALLA.

● WEST VIRGINIA—Wayde Stewart and Jay Sodowsky, joint managers of PARKERSBURG Municipal Airport, have purchased a new 5-place WACO cabin plane. It will be used for cross-country and charter trips. . . The BLUEFIELD City Council is considering acquisition of title to land needed for a municipal airport.

● WYOMING—WPA improvements costing $58,970 were under way at SHERIDAN Municipal Airport early in April. Improvements include grading and surfacing, construction of runways, installation of drainage and removal of high tension power lines.

Schools

● The BOEING SCHOOL OF AERONAUTICS Oakland (Cal.) has announced that blind flying students this summer may receive instruction on a block time basis. Instruction will be the same as for the regular Airline Pilot course, with primary instruction in light trainers of from 165 to 215 hp. and advanced instruction in transports up to 1,350 hp.

● The CURTISS WRIGHT TECHNICAL INSTITUTE OF AERONAUTICS, Grand Central Air Terminal, Glendale (Cal.) has recently placed fourteen graduates in jobs. Burchard W. Wilson has recently been added to the staff of instructors at the school. He will be in charge of sheet metal production methods.

● Early in April nine engines were at the same time in process of major overhaul in the engine department at PARKS AIR COLLEGE, East St. Louis (Ill.), according to Herbert Zimmer, assistant superintendent of the Master Mechanics' School. An engine test stand designed by him has been in use since December, 1935. It accommodates engines varying in horsepower from 30 to 1,000. Engine overhaul department is equipped with Oakite bath and sand blast for cleaning, microscopes for inspecting parts, drills, lathes, arbor press, milling machine, planer, and magneto testing machine.

● A class of 40 from the RYAN SCHOOL OF AERONAUTICS, Lindbergh Field, San Diego (Cal.) recently made an inspection tour of the Naval aircraft shops and operation department at North Island, San Diego. They were under the leadership of Floyd Adams and Walter Balch of the Ryan School.

● JOHN CROFFORD, Huntsville, (Ala.) has recently enrolled three new students. GLENN MESSER, of Birmingham (Ala.) Municipal Airport reports enrollment of eleven students, and KING AIRCRAFT SERVICE has enrolled ten. JOE LANE and his wife, BEATRICE, are planning to open a flying school at Rockridge, near Carmel (N. Y.). Norwalk (Conn.) Airport was scheduled to open for the summer May 1 with CHARLES WINZEL as chief instructor. He will be assisted by EDWARD BURNS. . . More than 150 students attended the opening session of the WPA aviation ground school at the HARTFORD (Conn.) public high school in April. Instructor G. FRED WENIGER . . . The subjects to be studied will be the theory of flight, elementary aerodynamics, air traffic rules, airplane structures and rigging, and aircraft engines. . . . The FOWLER SCHOOL OF AVIATION, Fowler, (Ind.) opened early in April. Student instruction will be under the direction of Carl A. Middleton . . . Arnold Chamberlin has been appointed instructor of the BEACON AERO CLUB, North Attleboro (Mass.). The club's plane will be flown from the Taunton airport during the summer. . . . The FLYING CLUBS OF AMERICA, which has been located at Pine Brook (N. J.) Airport has opened its own field at Hanover (N. J.). . . . About 38 students are taking flying instructions from W. Bryan Little, instructor and manager of LITTLE-GREINER FLYING SERVICE INC., Springfield (Ohio) Municipal Airport. . . . JACK NEWLAND, manager of the Waco Municipal Airport, has enrolled about twenty students for flying instruction. Flight training will be in a new Porterfield.

Aviation People

• Sixteen Americans and foreigners of high standing in engineering and aeronautics comprise the board of award for the Daniel Guggenheim Medal. This year they voted the honor to Dr. George William Lewis, since 1924 director of aeronautical research of the National Advisory Committee for Aeronautics, "for outstanding success in the direction of aeronautical research and for the development of original equipment and methods." Dr. Lewis has devoted twenty years to aeronautics, eighteen of them as a member of the NACA.

Dr. George William Lewis

• Aeronautics was represented in the annual Franklin Institute awards by Elmer A. Sperry, jr., vice-president of Sperry Products, Inc. He was one of four who received the 1936 Edward Longstreth Medal "in consideration of his initiative and for his work in the development of blind flying instruments employing gyroscopic principles, which development includes the gyroscopic horizon, directional gyro, and automatic airplane pilot." Formal presentation was made at Philadelphia on May 20.

Elmer A. Sperry

Burdette S. Wright

• Curtiss-Wright Corporation announces the election of Burdette S. Wright as president of its subsidiary Curtiss Aeroplane & Motor Company of Buffalo. He succeeds Ralph S. Damon, who resigned in December, 1935, to go with American Airlines as assistant to the president. Mr. Wright joined the Curtiss staff soon after his resignation from the Army in 1928 with the rank of major. His War record in France earned him American, French, and Belgian decorations. His peacetime activities included the organizing of an airway section and airway operations for the Army Air Corps while acting as aide to Brig. Gen. William Mitchell, serving as director of flying training at Kelly Field, later in the office of the Chief of the Air Corps at Washington as Chief of the Information Division.

• Orville Wright was elected a member of the National Academy of Sciences at its Washington meeting on April 29.

• Admiral Orin G. Murfin, Commander-in-Chief of the Asiatic Fleet, and Rear Admiral Harry E. Yarnell, Commander of the Fourteenth Naval District and of the Pearl Harbor Navy Yard, will exchange duties in October. Rear Admiral Yarnell will relieve Admiral Murfin of his command, being designated as Admiral while holding that command. Later that month Admiral Murfin will assume the duties as Commandant at Pearl Harbor, resuming his permanent rank of Rear Admiral.

• T. Park Hay, director of public relations for TWA since 1929, resigned on June 1. Mr. Hay made the first survey of possibilities of a national air express service and in 1929 organized the first such system. He later became the first chairman of General Air Express.

• Navy Department's official observers on the Hindenburg's round trip to Germany were Lt. Com. John M. Thornton and Lt. Howard T. Orville. Lt. Com. Thornton was at one time attached to the USS Los Angeles, served as aerological officer at Lakehurst, was assigned to the cruiser Richmond, and is now again stationed at Lakehurst. Lieutenant Orville served on the USS Langley in 1931, was transferred to the staff of the Commander of Battleships, Battle Force, as aerological officer, and now has charge of the aerographers' school at Lakehurst.

• England has awarded Jean Batten, Australian flier, the Royal Aero Club's Britannia Trophy for 1935, acclaiming her South Atlantic crossing the most meritorious air flight of the year.

• Eight Americans were presented with F.A.I. certificates by the National Aeronautic Association in Washington last month in recognition of newly established international aviation records. To Captains Orvil Anderson and Albert Stevens for stratosphere balloon flight of 72,394 ft. at Rapid City, S. D. in Nov. 1935; to Knefler McGinnis, J. K. Averill and T. P. Wilkinson, Navy pilots, and C. S. Bolka, A. E. J. Dionne and E. V. Sier, crew, for airline seaplane distance record of 3,281 miles from Cristobal Harbor, C. Z., to San Francisco Bay, Oct. 1935, and also for international broken line distance record of 3,443 miles; to A. P. DeSeversky, president of Seversky Aircraft Corporation, for amphibian speed record of 230 m.p.h. at Detroit, Sept. 1935; to Benjamin King, for airline distance record of 221 miles for single seater plane weighing less than 1,256 lb. from Port Washington, L. I., to Washington, June, 1935; and to Benjamin King and Daniel Brimm, co-pilot, airline distance record for multi-seated planes weighing less than 771 lb. in a 185-mile seaplane flight from North Beach, L. I. to Anne Arundel County, Md., June 1935; and to Helen Richey for speed record of 72 m.p.h. in the light plane class.

• The American Eagle-Lincoln Aircraft Corporation advises that through error they included the name of Marion P. Crews as their chief engineer in the information published in the March issue of Aviation. They call attention to the fact that Mr. Crews has not been associated with their company since 1932, but has been connected with the Manufacturing Inspection Service of the Bureau of Air Commerce.

• Recently elected to the directorate of Boeing Aircraft Company: Claire L. Egtvedt, Charles N. Monteith, Deitrich Schmitz, Fred P. Lauban, William M. Allen, Harold E. Bowman, Gardner W. Carr, Philip G. Johnson, Paul Pigott. The two latter are serving their first term. The others were re-elected.

• The Royal Aeronautical Society (England) has elected as fellow, A. Francis Archer, for the past six

years chief engineer of Waco Aircraft Company. Mr. Arcier contributed many developments to military aviation, notably the bomb dropping gear used by English air forces during the War which is still in use in modified form. He was made an associate fellow of the society in 1915.

• Officials of Taylor Aircraft Company announce several staff changes. WALTER JAMOUNEAU, for the past three years production consultant, has been promoted to chief engineer. His former post is filled by EDWARD R. BURN. PROF. GEORGE B. THORPE, assistant professor of aeronautics at Carnegie Institute of Technology, joins the staff as consulting engineer.

• Major E. E. Aldrin was re-elected president of the Daniel Guggenheim Medal Fund with Sherman M. Fairchild, vice-president. Major Lester D. Gardner, secretary, and John H. R. Arms, treasurer. The directors, being three representatives each from the Institute of the Aeronautical Sciences, the American Society of Mechanical Engineers, and the Society of Automotive Engineers, are Rear Admiral E. S. Land, Major E. E. Aldrin, Thomas A. Morgan, C. H. Chatfield, Major Temple Joyce, Prof. Baldwin M. Woods, Glenn L. Martin, Sherman M. Fairchild, and T. P. Wright.

• Ex-Cell-O Aircraft & Tool Corporation of Detroit has appointed A. D. HEATH as exclusive representative for the Southern Indiana territory. He will handle all of the company's products in this territory, including those of the Continental and Machinery Divisions.

• En route to Europe to represent Beech Aircraft Company this summer, JAMES H. HAIZLIP covered the first leg by air, flying a new Beech Cyclone from Wichita to New York on May 5.

• To head its corps of 5 air hostesses, TWA has appointed as chief hostess RUTH KATHRYN RHODES of Kansas City. MISS RHODES has been with the company since it added air hostesses to the crews of all its skyliners.

• JOHN MEHRING succeeds the late ARTHUR E. MITTNACHT as treasurer of Ethyl Gasoline Corporation, owned jointly by General Motors Corporation and Standard Oil Company of New Jersey. Mr. Mehring has been associated with the Ethyl Corporation since its organization in 1924, becoming assistant treasurer in 1927.

• DR. JEROME C. HUNSAKER, head of the mechanical engineering department of Massachusetts Institute of Technology, was elected to serve on the executive committee of the Division of Engineering and Industrial Research of the National Research Council for a period of three years.

Side Slips

By Robert R. Osborn

POSSIBLY it's just another sign of a lost youth, but it seems to us that many modern advancements are made at the expense of the romance of the old superseded institutions. The modern streamlined electric locomotive is a colorless efficient thing compared to the snorting, roaring locomotive of old, which belched black smoke and cinders along its path and dashed by waving its white plume of steam. And for pure romance, who would choose the Normandie or the Queen Mary against a square-rigger or a Mississippi stern-wheel steamboat? So it is with aeronautics. It is certainly

representative of modern progress for Mr. J. Edgar Hoover and his G-men to be delivering their arrested gangsters in a Douglas Transport, but we do regret the passing of the clanging bell of the old patrol wagon, and the 250 lb. 4 ft. wide, Irish policeman hanging on the rear step.

PICKED from the news ticker by C.G.G. of New York:

"WCNS70—The House Naval Affairs Committee favorably reported a bill authorizing an appropriation of $1,500,000 for a Navy airplane base at Tongue Point, Ore., 4/22—RB103P."

"WCNS71—Add Airplane Base, House. The Committee in reporting the bill reduced the requested appropriation by $1,500,000 4/22—RB104P."

Oh well, a moral victory anyway.

MR. HOWARD HUGHES must be proving to be a very startling type of speed pilot to the newspaper reporters—one who uses his airplane not only for the purpose of breaking records but for getting where he wishes to be. While interviewing him after he set the record from Miami to New York they asked him if he intended to fly back again to set the southbound record, and seem to have been surprised at his answer. "Why, I just came here from Miami because I wanted to be in New York."

WE SEE by the New York *Herald Tribune* that Pan American Airways has rented a store in the Chrysler Building, which will be used as an international ticket office for the sale of airline tickets to all parts of the world. As the store adjoins the lobby of the building it is stated "Edward Trumble, who painted the well-known ceiling mural in the Chrysler Building lobby, is making studies for wall murals having their inspiration in the romance of flight."

As we've never seen any murals by Mr. Trumble, the following suggestion cannot be construed as a personal criticism—we'd like to suggest that his preliminary sketches be studied from a technical standpoint and corrected by a number of people of long experience in aviation, so that the "romance" of his murals will not be spoiled by some glaring error. We realize that artists have a great scorn for accuracy, leaving that to the province of the engineer and the scientist, however we can't see why works of art would not be just as beautiful, and made without greater effort, accurately. We recall one very beautiful series of etchings, which would have been just as beautiful if one of them had not shown the "first flight" being made by Orville Wright *sitting* upright in a later Wright model, instead of lying down on the lower wing of the first airplane. A recent excellent pencil sketch by an artist who had been an aviator, and therefore should have known better, showed the World's landplane speed record being broken by Mr. Hughes' monoplane with the retractable landing gear in the extended position. Many other instances could be mentioned but the prize one of all was the beautiful set of bronze book ends turned out by some sculptor to commemorate Lindbergh's Paris flight. His sculpture

showed the "Spirit of St. Louis" flying through some clouds with the tail-skid dolly still in place.

Please, Mr. Trumble, is it too much to ask for a little accuracy, so that even those in "this airplane business" will enjoy your work?

ONCE again we take our editorial hat off to Lauren D. Lyman, esteemed aviation reporter of the New York *Times*, who was awarded the $1,000 Pulitzer Prize for the best reporting job of the year.

Classified Advertising

10 CENTS A WORD — $2.00 MINIMUM

Planes, Engines & Parts For Sale

WACO 10, ship and engine reconditioned. Relicensed for one year from date of purchase. Nelson Flying Service, Wyckoff, N. J. No 1

BEAUTIFUL 3-PLACE open cockpit Ryan Speedster, J6 5 powered, total time 159 hours, $1,500. 5832 Hurlbut Avenue, Detroit, Michigan. No. 2

TWO—D-25 STANDARDS J5 motors. One total time 400 hours, 60 since major overhaul and one total time 800 hours motor just majored, no air time. Any reasonable offer considered. Cypress Sessions's Aviation School, 157 Charter Oak Avenue, Hartford Conn. No 3

ENGINES AND PARTS for sale. Liberty 400 hp., Hispano E 180 hp. Also quantities of Pratt & Whitney Wright Curtiss and Packard engines—see page 69. The Vimalert Company, Ltd., 841 Garfield Ave., Jersey City N J. No 4

125 WARNER complete with shielded plugs Hamilton rod Mags—no time since thorough major—best offer over $400.00 takes it. FS 337 Aviation 330 W 42d St N Y C. No 5

NEW AIRPLANES $25.00 down, easy payments. 7.00x4 Air Wheels with hubs $16.00 per set. Propellers $2.98 up. Send 25c. for information. Hibbs Fort Worth, Texas. No 6

PARTS Wright Cyclone 1750-C Loening Amphibian C-2-C, 15.00x16 tires, tubes wheels and brakes 40x10 tires and tubes, accessories. Low prices. Write for our list. Pennsylvania Airlines & Transport Co., Municipal Airport, Cleveland Ohio. No 7

BELLANCA SKYROCKET. In A-1 condition. Equipped with wheel pants and radio. License just renewed. A good buy. Western Light & Telephone Company, Huron Bldg., Kansas City, Kansas. No 8

WACO 1935, 225 Jacobs 180 hours total time, selling to get new demonstrator. Bargain. Aviation Associates, Inc. Curtiss Airport, East St. Louis, Ill. No 9

ENGINE OVERHAUL TOOLS—Wright and Lycoming—New Wright Engine Parts—also Wasp—fine lot of used parts—Pioneer Manometer for testing Airspeeds—New Flexible Steel Tubing—Aircraft Bolts all sizes—BG Spark Plugs—BG Cup Setting Tools—Altimeters—Landing Light Bulbs—Wiley Flares. Pontiac Aircraft Company Pontiac, Mich. No. 10

BUHL BULL PUP—Steckley 45, airwheels, airspeed, like new, 85 hours since new. $460.00. Charles Snyder, Oak Ave., Lockport Illinois. No 11

J5 TRAVELAIR. Hand rubbed finish. Condition perfect, $1,175.00. $597.50 down. St. Louis Flying Service Inc., Lambert Field, St. Louis, Missouri. No. 12

WACO F2, excellent condition, color blue and yellow, Jacobs 170 recently factory majored, plane just relicensed. Heywood starter, navigation and landing lights, flares, metal cockpit cover, wasp cone fairing, wheel pants. Snappy performance. $2,000. John Abruzzo, Sunbury Airport, Sunbury, Pa. No 13

NEW CESSNA DEMONSTRATOR, 145 hp Warner, extra equipment, turn and bank, rate of climb, RCA radio, retractable landing lights, $4,500.00. Sundorph Aeronautical Corp., Cleveland, Ohio. No 14

WINGS all kinds. Try our wing exchange. Also spars, ribs, slip-on covers and dope. N. L. Aircraft Co., Vermilion, Ohio. No 15

WACO CABIN JACOBS. 34 model, motor modernized, extras: special 70 gal. gas, landing lights, flares, bank and turn, rate of climb, prepared for radio, air brakes, thermometer, special paint job. The most exceptional buy of the year, at $5,750. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio. No 16

CORRECTION. This advertisement in the May issue contained a typographical error showing incorrect price. The above is correct.

LYCOMING R-680 for sale, needs top overhaul. First offer over $175.00 takes it. Goodwill Air Service, Modena Airport, Brandywine P. O., Pa. No 17

AEROMARINE KLEMM with 85 hp. Le Blond motor, steel propeller, airwheels, good condition. Pine Brook Airport, Pine Brook, N. J. No 18

STINSON Model W, Wasp Jr., black and silver, covering excellent, just relicensed, turn and bank, rate of climb, clock, thermocoupling, air speed, compass, electric starter, special leather upholstery. $2,500. Fairchild Cabin 24, 2 place Warner motor, red and black, excellent condition throughout, just relicensed, special leather upholstery, Eclipse air starter, $2,500. Learn to Fly special solo course $50.00. Flying now available in new Taylor Cubs, Fleet Sport Trainer, Fairchild Cabin and Stinson planes. White Flying Service, Inc., Caldwell Wright Airport, Caldwell, N. J. No 19

SAVOIA MARCHETTI 3 place amphibian, Kinner powered, engine 150 hours since majored, plane just relicensed. Heywood starter, navigation lights, compass, clock, rate of climb and level gauge. Color silver and red. Ideal for use on lake or river. A real buy for $750. Manager Sunbury Airport, Sunbury, Pa. No. 20

STINSON SR-5E, Flaps, for sale, 230 hrs., none since overhaul. Cream and blue. Landing lights, flares, blind flying instruments, wired for radio, large tanks. Priced reasonable. State Trade School, Putnam, Conn. No 21

TRI MOTOR STINSON airliner. Radio, landing lights, flares, rate of climb, turn and bank, airline condition, $2,650.00. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri. No 22

PORTERFIELD Demonstrator. J6 Robin Wright Gipsy Travelair Trainer. All first class, priced to sell. Tuckington Aviation Co., Municipal Airport, Indianapolis, Ind. No 23

OX5 IDENTIFIED LINCOLN PAGE biplane, one hour since recovered, new overheads, dual control $130.00. Arnold Garbetson, 509 North Third St., Marquette, Mich. No 24

CESSNA J6-9, night flying and instrument flying equipment, RCA radio, Aero struts, streamline tires, excellent condition. $2,750.00. Sundorph Aeronautical Corp., Cleveland, Ohio. No 25

STEARMAN Wright J5, completely recovered, motor major overhauled, complete set of instruments, priced $1,500.00. No 26

WARNER INDUCTION HOUSING $37; J6-9 Crankshaft $70. Kinner and Warner Valve Guides intake 90c, exhaust $1.00. Write for your new 1936 catalogue. Snyder Aircraft Company, Municipal Airport, Chicago, Ill. No 27

WACO: Custom De Luxe; five-place cabin demonstrator, like new. Cost over $7,700. Sacrifice to make room for new models. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio. No 28

125 HP WARNER BIRD, equipped for instrument flying, RCA radio, Aero struts, streamline tires. $2,150.00. Sundorph Aeronautical Corp., Cleveland, Ohio. No 29

BEARWIN SPORTSTER built last December. Only 95 hours total time, $1,795.00. $897.50 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri. No 30

PA6 PITCAIRN J5, ship and motor. Just had major overhaul. Goodyear airwheels and brakes. A bargain at $1,150.00. FS-359 Aviation, 330 West 42d Street, New York City. No 31

AVRO-AVIAN A-1 condition, air wheels, $500.00. OX Waco, $350.00. Harry R. Playford, Cleveland Airport, Cleveland, Ohio. No 32

BROTHER CAN YOU spare a dime? If you can send it to me and I'll send you my 1936 Low Priced Aviation Material Catalog. (Canada 25c.) Karl Ort, 605 West Poplar, York, Penna. No. 33

1935 TAYLOR CUB for sale, late A-40-3 type motor, ship and motor less than 100 hours, guarantee perfect, always privately owned, $925.00. Also 1936 Cub demonstrator, 40 days old, new plane and motor guarantee, $175.00 off. J5 Stinson, new upholstery, covering good, 10 hours on motor since complete major, $1,150.00. Detailed information upon request. Southern Air Services, Inc., Municipal Airport, Memphis, Tennessee. No 34

FAIRCHILD 24—Warner 145. Three-place. Landing lights, flares, bonded for radio, rate of climb. Four hours since complete major on engine. $3,675.00. Will finance or take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri. No 35

WACO J5, straightwing model, just relicensed and in perfect condition. Many spare engine parts, $1,100. Devereaux, 356 Beach 13th St., Far Rockaway, N. Y. No 36

J5 STINSON 4-place, licensed December 1936. Motor majored, new wheels, full instruments, $1,000, consider trade. O. E. Dickerhoof, Chanute, Kansas. No 37

KINNER BIRD, Kinner Sportster low wing, Avro-Avian, Wasp-Stearman, American Moth, Waco F Warner, Lycoming Stinson. Others. Chuck O'Connor, Barnes Airport, Westfield, Mass. No. 38

PRIVATEER AMPHIBIAN—125 Warner powered, starter, 10 hours since complete major overhaul, licensed to March 1937. Smith Flying Service, Wyoming Valley Airport, Wilkes-Barre, Pa. No 39

PROPELLERS. Hamilton Standard—Reconditioned to our Government Approved Station—J5 $65, J6 $70, Lycoming $85. J5 Hubs, $20, J6 Hubs $25. Three-Way Hubs for Test Purposes, $15. Carburetors J6-9, Reconditioned, $35. Magnetos J5 or Wasp Overhauled $20. Cylinders J5 $15. Starters Series 6 or 16, Hand Inertia, $20. General Aeromotive Corporation, Municipal Airport, Cleveland, Ohio. No 40

SAVOIA MARCHETTI perfect condition, $700. J5 Travelair, just majored, complete set of instruments $1,500.00. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio. No 41

WACO 1932, 210 Continental engine, full night flying and ambulance equipment, gray and silver, licensed $2250. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Ill. No 42

2 CYL. LAWRENCE with prop $40.00. 1/32" plywood 10c. sq. ft., quantities less. Wire Hose E2 or E4. Fort Wayne Aviation Co., B. J. Means Airport, Fort Wayne, Ind. No. 43

GUARANTEED USED STINSONS AND WACOS. Some used less than 200 hours total time. Stinson SM8A, R, 1933, 34 and 35 Reliance. Also 1934 Waco, motor recently overhauled at Continental factory. Gypsy Moth and J6-3 Commandaire both with beautiful new covering, rubbed finish. All licensed and in first class condition, with right prices. Chicago Aviation Corporation, Glenview, Illinois. No 44

STINSON "R"—complete blind flying instruments and hood—75 gal. gas, Landing Lights, Flares, Radio, $2,750.00. Other ships for sale. 24 hour Charter Service. Approved Repair Station No. 47. Eastern Aeronautical Corp. Airport, Newark, N. J. No. 45

CHALLENGER ROBIN—perfect condition. Ship 800 hours, engine 120 hours, licensed to December 1st 1936. Standard Aviation, Hasbrouck Heights, N. J. No. 46

WARNER CESSNA. Recently completely overhauled, four place. Price $900.00, air wheels and steel prop. Pioneer Aircraft Co., Teterboro Airport, Hasbrouck Heights, N. J. No 47

GYPSY MOTH, latest type, slots, airwheels, $650. OX5 Longwing Eaglerock, $225. Arrow Sport, Velie motor, $500. Spartan SR 3-9 motor, excellent $450. Velie M5 perfect $125. Consider trades, cars, small business, etc. Kidd, Box 195, San Antonio, Texas. No 48

AERONCA C-3. New motor, landing lights, streamline wheels. Aeronca E113 & E113A engines and engine parts. Aeronca right wing and tail group like new. Wright J6 and J5 cyls. Wiley flares newly reconditioned. Cash terms or trade. B. M. Lloyd, 1724 Oakland St., Ft. Wayne, Indiana. No 49

STINSON SM8A just relicensed, motor, 180 hours since modernization, new battery, landing lights, fabric and interior excellent. Never damaged. See to appreciate. $1,375. Set 950x12 Semis brakes, tires, tubes, adapters very good. $75. Mankato Aero Service, Mankato, Minnesota. No 50

KINNER MONOSPORT $950. Tank Robin $775. OX Eaglerock $450. Lincoln-Page $450. Hisso Ryan 5POLM $250. Velie Coupe, want lower right Eaglerock A-2 wing, Imm, Fergus Falls, Minnesota. No 51

BIRD, Kinner, 160 hp., front cabin, full airwheels, $1,400. Bird, Warner 125 hp., starter, brakes, many extras $1,850. Monocoupe, 1932 Warner 125 hp., starter and blind flying instruments, $2,250. The Welz Corporation, Central Airport, Camden, N. J. No 52

TAYLOR CUBS 1935 $850 up. Eaglerock for sign towing, $450 less motor. Bearwin Sportster demonstrator $1,600. Others available soon. Write your needs. Bennett Air Service, Hightstown, N. J. No 53

AMERICAN EAGLE K5, steel prop., licensed, airwheels, night flying equipment, dual controls, newly rebuilt. Will sacrifice for quick sale $750. R. S. Atkinson, 5914 So. California, Chicago, Ill. No 54

J-5 FAIRCHILD, 5 place cabin, excellent condition. Licensed Apr., 1937, $850. Also J5 Travelair, Warner Waco, J6-5 Ambassador, Stinson S. Air Activities Airport, West Chicago, Ill. No 55

HAMILTON-STANDARD steel propeller fits Continental, Lycoming and Wright. Excellent condition, will sell for $85.00. John Abruzzo, Sunbury Airport, Sunbury, Pa. No. 55A

NUMBER INDEX of Display Advertisers
(Index Numbers are at the Right)
(Page Numbers are at the Left)

Products

Covers

WHEN YOU RECOVER use "Fit Right-Stay Tight" slip on covers. Made for sixty planes. Genuine Flightex. Deferred payment plan. Dope, Tape, etc. Swanbrook Aviation Co., Ft. Wayne, Ind.

Duplicators

MULTIPRINT your forms, menus, etc. Complete letter size outfit, sent postpaid C.O.D. You pay postman only $1. Multiprinter, 5718 Woodlawn, Chicago.

Flares

WILEY 3-MINUTE FLARES factory reconditioned, while they last $22.50 each. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Ill.

Parachutes

NEW AND USED CHUTES bought sold and exchanged. Can make good offer on used chutes toward the purchase of new ones. Joe Crane, Roosevelt Field, Mineola, L. I., N. Y.

Services

Patent

PATENTING INVENTIONS is my Specialty—through 29 years as Registered Patent Attorney 7780. Also Trademarks Investigations Opinions. Ask me for "Special Offer to Mfr. Officials and Engineers." Sterling P. Buck, A-9 629F N. W. Washington, D. C.

Special

GOVERNMENT CHARTS and Publications. Navigation Instruction and Equipment. Home Study and Residence Courses. New and Reconditioned Watches, Sextants, &c. Consultant for Laying Courses and Planning Flights. Write Weems System of Navigation, Annapolis, Md.

Wanted

WANTED FOR CASH. Model 51 Fairchild or will sell complete float equipment for same. Will consider purchasing F-C-2 Fairchild. Chuck O'Connor, Barnes Airport, Westfield, Mass.

VELIE MONOPREP wanted, Lambert Monocoupe or Aeromarine Taylor Cub. We pay cash. Give complete dope in first letter. Box 597, Dundee, North Dakota.

TAIL WHEEL ASSEMBLY for J5 Waco wanted. M. C. Taylor, 112 Sunset Place, Latonia, Ky.

Positions Vacant

LICENSED AIRPLANE and engine mechanic wanted to qualify as instructor in established public apprentice school. Approved Repair Station. High School graduate, 3 years apprenticeship, over 5 years journeyman experience, technical training desirable. Give full particulars first letter. P. O. Box 446, Putnam, Conn.

Positions Wanted

Rate 5 cents a word, $1.00 minimum

1932 MECHANICAL ENGINEERING Graduate desires position in aeronautical field. Four years design, inspection and administrative experience. Good references upon request. PW-327, Aviation, 520 No. Michigan Ave., Chicago, Ill.

TRANSPORT PILOT—1500 hours, 800 tri-motor, formerly with Pan American, West Indies and Central America. PW-330, Aviation, 330 West 42d Street, New York City.

Are you looking for a position in the aviation field?
Why not put an ad in Aviation's July issue?

June 1936 Issue

Classified Advertising INDEX

AVIATION SCHOOLS

Planes, Engines and Parts For Sale
PRODUCTS—SERVICES

For Additional Advertising of

Schools Flight, Flying and Navigation Instruction

Consult these headings under "Services" in the Classified Advertising Index on page 67.

INDEX TO ADVERTISERS

The Birdmen's Perch

Let's have 'em, fellows This is your page — so speak right our in meeting Send in every yarn, bit of gossip and personal experience that comes your way We're getting great stuff all the time . . . but can always use more

MAJOR AL WILLIAMS, *Manager Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh Pa

IN AND OUTER

During a dogfight in the World War a German, flying a Junker armored plane, hit an airpocket and was tossed out on the wing Just as the Heinie was figuring that he'd try to render a last service to his country by landing on a French general, the plane hit an other pocket and tossed him neatly back into the cockpit

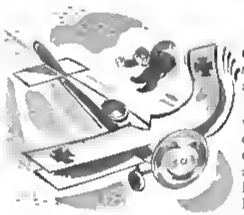
He wasn't a member of Von Richthofen's Flying Circus, either

—R O G

DID YOU KNOW?

That Benny Howard and Harold Neuman in winning the two most important events at the National Air Races, the Bendix and Thompson Trophy Races, fueled with Gulf Aviation Gas and lubricated with Gulfpride

Pennsylvania Air Lines, one of the biggest users of Gulf Aviation Gasoline, celebrated its ninth birthday April 26th Ticket number 103,103 was presented to Mr Alexander Howie, of Cleveland, who used to fly the line back in the days when they threw a passenger in among the mail bags, stamped him "Special Delivery," and limited his baggage to his watch and keys



WORKING THE NIGHT SHIFT

C M, of Pennsylvania, sends us this one about a local flying club

Our field is cursed with a wind that changes direction every five minutes and our plane is so light we have to shift her each time the wind veers, so she won't turn over

The night after one of the boys had spent a particularly shifty day, his wife dreamed she was seasick and awoke to find hubby, sound asleep, hauling the foot of her bed around towards the window

She squawked and asked exactly what was going on "S'all right," mumbles the sleepy one "I'm just turning her tail into the wind so she won't upset!"

THIS MONTH'S WHOPPER

Gentlemen— 'Tis due directly to ye re donned Gulfpride Oil that a MacNeille—o the Hieland MacNeilles — languishes in a Yonkee hoosegow

In pursuit o' my duties as chief mechanic o the airport, I noticed that the flyin' laddies wad no touch any other oil but Gulfpride Aye, they were fair close to bein' narrow-minded on the subject

The advantages of the situation were obvious 'Twas but the wairk of an evenin to filter through mosquito nettin' twa barrels o' Gulfpride which the lads ha' drained fra' their crankcases after monny a mile o' sairvice And twas but a wee job selling them their ain oil back again at a handsome profit to masel'

A bonny plan indeed, and should ha' yielded me a deal o' pence for you Gulfpride ran as gude as before In fact, it ran sae gude it tempted me to tur-rn an extra penny!

At fir-rst, when I put a quar-rt of water in each gallon, the lads didna notice for the oil ran pairfectly But when its admirable pairformance led me to try thr-r-ee dropa of Gulfpride to a quar rt of water, ye re oil betrayed my tr-rust It wad no be fittin' for me to tell ye what the flyin' laddies said when they found out, but may ye never see men gae daft wi' rage!

Tis plain that Gulf is responsible for my confinement and should provide my bail And since it is a matter of impor r-tance, can ye no harry up a bit?

ANGUS MACNEILLE

Eclipse advances the development of hydraulic control with NEW HYDRAULIC PUMPS

Eclipse Engine Driven Hydraulic Pump

Eclipse Electric Motor Driven Hydraulic Pump for 12 or 24-volt operation

THE Eclipse Engine Driven and Electric Motor Driven Hydraulic Pumps are now available, after extended development and exhaustive tests. They provide a reliable oil pressure source for the hydraulic control of retractable landing gear, wing flaps and retractable wing tips or floats. The design principle employed assures the maintenance of high operating pressures with minimum service requirements.

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